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MINERALS YEARBOOK 2006

Area Reports: International 2006

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U.S. Department of the Interior
U.S. Geological Survey

MINERALS YEARBOOK

Area Reports: International 2006

Africa and the Middle East

Volume III

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U.S. DEPARTMENT OF THE INTERIOR
KEN SALAZAR, Secretary

U.S. GEOLOGICAL SURVEY
Suzette M. Kimball, Acting Director

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Foreword

This edition of the U.S. Geological Survey (USGS) Minerals Yearbook discusses the performance of the worldwide minerals and materials industries during 2006 and provides background information to assist in interpreting that performance. Content of the individual Minerals Yearbook volumes follows:

- Volume I, Metals and Minerals, contains chapters about virtually all metallic and industrial mineral commodities important to the U.S. economy. Chapters on survey methods, summary statistics for domestic nonfuel minerals, and trends in mining and quarrying in the metals and industrial mineral industries in the United States are also included.
- Volume II, Area Reports: Domestic, contains a chapter on the mineral industry of each of the 50 States and Puerto Rico and the Administered Islands. This volume also has chapters on survey methods and summary statistics of domestic nonfuel minerals.
- Volume III, Area Reports: International, is published as four separate reports. These regional reports contain the latest available minerals data on more than 190 foreign countries and discuss the importance of minerals to the economies of these nations and the United States. Each report begins with an overview of the region's mineral industries during the year. It continues with individual country chapters that examine the mining, refining, processing, and use of minerals in each country of the region and how each country's mineral industry relates to U.S. industry. Most chapters include production tables and industry structure tables, information about Government policies and programs that affect the country's mineral industry, and an outlook section.

The USGS continually strives to improve the value of its publications to users. Constructive comments and suggestions by readers of the Minerals Yearbook are welcomed.

Suzette M. Kimball, Acting Director

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Contacts

Information about the U.S. Geological Survey, its programs, staff, and products may be accessed on the World Wide Web at http://www.usgs.gov or by contacting the Earth Science Information Center at 1-888-ASK-USGS. For specific information about this publication, contact the Chief, International Minerals Section, Minerals Information Team, at (703) 648-7732, or the Team secretary at (703) 648-4961. Additional minerals information may be accessed on the World Wide Web at http://minerals.usgs.gov/minerals.

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Acknowledgments

The Country Specialists in the Minerals Information Team, U.S. Geological Survey, in preparing the International Review regional books of volume III of the Minerals Yearbook, extensively use statistics and data on mineral production, consumption, and trade provided by various foreign Government minerals and statistical agencies through various official publications. The cooperation and assistance of these organizations are gratefully acknowledged. Statistical and informational material was also obtained from reports of the U.S. Department of State, United Nations publications, and the domestic and foreign technical and trade press. Of particular assistance were reports submitted by the Resource Reporting Officers and other officers of the Department of State in U.S. Embassies worldwide. Their contributions are sincerely appreciated. Internal statistical support was provided by the staff of the Data Collection and Coordination Section of the Minerals Information Team.

The regimes of some countries reviewed in this volume may not be recognized by the U.S. Government. The information contained herein is technical and statistical in nature and is not to be construed as conflicting with or being contradictory of U.S. foreign policy.

John H. DeYoung, Jr.
Chief Scientist, Minerals Information Team

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THE MINERAL INDUSTRIES OF AFRICA

By Thomas R. Yager, Omayra Bermúdez-Lugo, Philip M. Mobbs, Harold R. Newman, Glenn J. Wallace, and David R. Wilburn

The 55 independent nations and other territories of continental Africa and adjacent islands covered in this volume encompass a land area of 30.4 million square kilometers, which is more than three times the size of the United States, and were home to 937 million people in 2006. For many of these countries, mineral exploration and production constitute significant parts of their economies and remain keys to future economic growth. Africa is richly endowed with mineral reserves and ranks first or second in quantity of world reserves of bauxite, cobalt, industrial diamond, phosphate rock, platinum-group metals (PGM), vermiculite, and zirconium.

The mineral industry was an important source of export earnings for many African nations in 2006. To promote exports, groups of African countries have formed numerous trade blocs, which included the Common Market for Eastern and Southern Africa, the Economic and Monetary Community of Central Africa, the Economic Community of Central African States, the Economic Community of West African States, the Mano River Union, the Southern African Development Community, and the West African Economic and Monetary Union. Algeria, Libya, and Nigeria were members of the Organization of the Petroleum Exporting Countries (OPEC). The African Union was formally launched as a successor to the Organization of African Unity in 2002 to accelerate socioeconomic integration and promote peace, security, and stability on the continent.

The U.S. Geological Survey (USGS) acknowledges and expresses its sincere appreciation to the following Government agencies, international institutions, and private research organizations for providing mineral production statistics, basic economic data, and mineral exploration and other mineral-related information:

For mineral production statistics—

- Algeria—Ministry of Energy and Mines,
- Botswana—Department of Mines,
- Burundi—Ministry of Energy and Mines,
- Cameroon—Ministry of Industry, Mines, and Technological Development,
- Central African Republic—Ministry of Energy,
- Egypt—Central Agency for Public Mobilization and Statistics,
- Eritrea—Ministry of Energy and Mines,
- Ethiopia—Ministry of Mines and Energy,
- Ghana—Minerals Commission,
- Guinea—Ministry of Mines,
- Kenya—Ministry of Environment and Natural Resources,
- Liberia—Ministry of Lands, Mines, and Energy,
- Malawi—Department of Mines,
- Mauritania—National Office of Statistics,
- Mauritius—Ministry of Agro Industry and Fisheries,
- Morocco—Office Cherifien des Phosphates,
- Mozambique—National Directorate of Mines,
- Namibia—Ministry of Mines and Energy,
- Niger—National Institute of Statistics,
- Senegal—National Agency of Statistics and Demographics,
- Sierra Leone—Ministry of Mineral Resources,
- South Africa—Department of Minerals and Energy, Mineral Economics Directorate,
- Swaziland—Central Statistical Office,
- Tanzania—Ministry of Energy and Minerals,
- Tunisia—National Institute of Statistics,
- Uganda—Department of Geological Survey and Mines, and
- Zimbabwe—Chamber of Mines.

For basic economic data—the International Monetary Fund in the United States.

For minerals consumption data—

- British Petroleum plc,
- Department of Minerals and Energy of the Republic of South Africa,
- MEPS (International) Ltd., and
- U.S. Department of Energy.

For exploration and other mineral-related information—the Metals Economics Group (MEG) in Canada.

General Economic Conditions

In 2006, the real gross domestic product (GDP) of Africa increased by 5.5% after increasing by 5.6% in 2005. From 2000 to 2005, Africa's GDP increased at an average annual rate of about 4.7%. In 2006, the GDP increased by an average of 5.9% in African petroleum-exporting countries and by an average of 5.3% in African petroleum-importing countries. GDP growth in African petroleum-exporting countries was projected to be at or about 9.5% in 2007 and at or about 7.3% in 2008. In petroleum-importing countries, GDP growth is expected to be at or about 4.8% in 2007 and at or about 5.2% in 2008 (International Monetary Fund, 2007, p. 75, 196).

Investment Data and Political Risk

The Department of Minerals and Energy of the Republic of South Africa reported that investment in newly committed precious metals projects in South Africa (that is, those in which funds had already been committed or were being expended) was $4.04 billion in 2006. PGM accounted for 36% of the investment; gold, 28%; and other minerals, 36%. An additional $3.04 billion was reported for potential precious metals projects in South Africa (that is, feasibility-level projects for which funds had not yet been committed). PGM accounted for 74% of the investment; gold, 1%; and other minerals, 26%. Investment in newly committed processed minerals projects amounted to $1.34 billion, and potential processed minerals projects, $896 million (Mwape and others, 2007, p. 24, 25).

Capital expenditure for the heavy mineral sands project at Mandena in Madagascar was expected to total $585 million by

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2008, and that at Moma in Mozambique, $348 million. By 2012, capital expenditures for bauxite and alumina at the Dian Dian and the Friguia Mines in Guinea were likely to total $2.8 billion; nickel in Madagascar, $2.25 billion; and coal in Mozambique, $2 billion. Substantial capital expenditures were also likely for cobalt and copper in Congo (Kinshasa) and Zambia, crude petroleum in Nigeria and Sudan, iron ore in Senegal, and natural gas in Nigeria.

Countries directly affected by wars, internal ethnic or political conflicts, and refugee displacements in 2006 included Angola, Burundi, Central Africa Republic, Chad, Congo (Kinshasa), Côte d'Ivoire, Nigeria, Somalia, Sudan, and Uganda. In 2006, the Government of Burundi signed a peace agreement with the Forces for National Liberation.

Legislation

High metals prices and the resulting large mining company profit margins have triggered a reevaluation of mining royalty rates by several African Governments. In Namibia, new royalty levies were announced; precious, base, and rare metals would be charged at a rate of 3% of gross sales; semiprecious stones and industrial minerals would be charged at a rate of 2%; diamond revenues were left exempt. The South African Government has proposed legislation that would impose royalty rates of 5% for diamond, 3% for refined platinum, and 1.5% for refined gold. Zambia planned to increase the royalty rate on mining sales to 3%, increase income tax rates on mining companies to 30%, and reintroduce a 15% withholding tax on selected sources of revenue, while providing other incentives to stimulate mining (Mukumbira, 2006; Mwila, 2006; Sergeant, 2006; Kruger, 2007).

The Government of Zimbabwe has approved amendments to the nation's Mines and Minerals Act that concern Government participation in all mining activities. As a followup to this legislation, the Government approved an agreement with Zimbabwe Platinum Mines Ltd. (Zimplats) whereby Zimplats would release 36% of its resource base to the Government in return for cash and empowerment credits; all remaining mining claims would be incorporated into a special mining lease that applies to current operations. The Gold Trade Act of 2006 mandated penalties for illegal possession or trading of gold (Engineering and Mining Journal, 2006).

In Equatorial Guinea, law No. 9/2006, which was the new mining law, replaced law No. 9/1981. Law No. 8/2006, which was the new hydrocarbon law, replaced law No. 7/1981 and its amendments. In Chad, law No. 002/PR06 amended the Petroleum Revenue Management Law (law No. 001/PR/99 of 1999), which defined the allocation of petroleum revenues. The Government of Zambia promulgated the Zambia Development Agency Act, which covered investment in most types of mineral operations. Minerals produced for the construction industry, such as clay, sand, and most types of stone, were not included in the new law.

Exploration

Exploration activity, as defined in the African exploration budgets reported by the MEG, increased by 41% to US$1.1 billion in 2006 from $807 million in 2005. The Africa exploration budget share decreased slightly to 16% of the world exploration budget in 2006 from 16.5% in 2005. In 2006, the principal mineral targets in Africa were copper, diamond, gold, and PGM (Metals Economics Group, 2006).

Gold projects accounted for approximately 50% of reported African exploration projects, diamond projects represented about 16%, copper and PGM projects each made up about 10%, and lead-zinc projects accounted for 5%. Early-stage projects made up about 82% of the 2006 activity, and feasibility-stage projects represented about 8%. Exploration was focused primarily on, in order of the number of sites, South Africa, Ghana, Mali, Congo (Kinshasa), Tanzania, Burkina Faso, Zambia, and Namibia, but activity also took place in a number of other countries.

Australian and Canadian junior companies continued to invest time and money to explore in Africa. South African companies, while spending a sizable amount of their exploration resources overseas, had begun to reinvest in African exploration, with a focus outside of South Africa. De Beers SA planned to spend one-half of its 2006 exploration budget in central Africa, with Congo (Kinshasa) as its top priority (Ruffini, 2006). In 2006, the African mining sector benefited from the currency exchange difference between the South African Rand and the U.S. dollar, as well as increased investment from China and India.

Commodity Overview

Estimates for the production of major mineral commodities for 2006 and beyond have been based upon supply-side assumptions, such as announced plans for increased production/new capacity construction and bankable feasibility studies. The outlook tables in this summary chapter show historic and projected production trends; therefore, no indication is made about whether the data are estimated or reported and revisions are not identified. Data on individual mineral commodities in tables in the individual country chapters are labeled to indicate estimates and revisions. The outlook segments of the mineral commodity tables are based on projected trends that could affect current (2006) producing facilities and on planned new facilities that operating companies, consortia, or Governments have projected to come online within indicated timeframes. Forward-looking information, which includes estimates of future production, exploration and mine development, cost of capital projects, and timing of the start of operations, are subject to a variety of risks and uncertainties that could cause actual events or results to differ significantly from expected outcomes. Projects listed in the following section are presented as an indication of industry plans and are not a USGS prediction of what will occur.

Metals

Aluminum and Bauxite and Alumina.—*Production.*—In 2006, African production of refined aluminum increased by 8%. South Africa's production increased because of higher output from the Bayside and the Hillside smelters. In Ghana, output increased at the Valco smelter; production, however,

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was constrained by limited power availability resulting from low water levels in Lake Volta. Production also increased at the Mozal smelter in Mozambique and the Nag Hammadi smelter in Egypt. South Africa accounted for about 48% of African aluminum output; Mozambique, 30%; and Egypt, 14% (table 6). Kenya was the only African producer of secondary refined aluminum. Africa accounted for 4% of the world's aluminum production in 2006 (table 4).

African bauxite production increased by 10% in 2006. Most of the increase was attributable to the reopening of the SML bauxite mine in Sierra Leone. Guinea accounted for about 89% of African bauxite production, and Sierra Leone, 6% (table 5). From 1990 to 2006, Africa's share of world bauxite production decreased to 10% from 16%.

Consumption.—In 2006, world aluminum consumption amounted to 34 million metric tons (Mt) compared with 31.7 Mt in 2005. African consumption of aluminum increased to 480,000 metric tons (t) in 2006 from 408,000 t in 2005 (Maphango, 2007a).

Outlook.—The production of refined aluminum is expected to increase by an average of about 3% per year from 2006 to 2013. In Cameroon, Alcan Inc. plans to triple production from its smelter by 2011. Aluminum Smelter Co. of Nigeria Ltd. could reopen its smelter at Ikot Abasi by 2008 and reach full capacity by 2011. In Ghana, Alcoa Inc. plans to increase production at the Valco smelter; higher output depended upon reliable power supplies (table 6).

African bauxite production is likely to increase by an average of about 9% per year from 2006 to 2013 (table 5). In Guinea, the Debele, the Friguia, the Kamsar, and the Sangaredi Mines are expected to reach full capacity in 2009. The Dian-Dian Mine is likely to open by 2013. Bauxite mining in the Kambia District could restart by 2013. Sierra Leone, which did not mine bauxite between 1995 to 2005, could have a 14% share of African bauxite production in 2013 (table 5).

Copper.—*Production.*—Africa's mine production of copper increased by nearly 14% in 2006. Zambia was the leading producer in Africa; the country's increasing production was partially attributable to higher output from the Kansanshi Mine. The production increase in Congo (Kinshasa) was attributable to the opening of the Kananga, the Ruashi, and the Tilwezembe Mines and higher output from the Dikulushi and the Kulu Mines. The Guelb Moghrein Mine started production in Mauritania in 2006. In 2006, Zambia accounted for 65% of African copper mine production; Congo (Kinshasa), 17%; and South Africa, 13% (table 7). Africa's share of world copper mine production was 5% in 2006 compared with 14% in 1990.

Africa's refined copper production rose by 13% from 2005 to 2006; most of the increase was attributable to Zambia. Output also increased in South Africa. In 2006, Zambia accounted for 79% of African refined copper production; South Africa, 18%; and Egypt, 2% (table 8). Egypt was the only producer of secondary refined copper; primary production accounted for most African production.

Consumption.—In 2006, world refined copper consumption increased to 17.1 Mt from 16.8 Mt in 2005. African consumption of copper amounted to about 160,000 t in 2006. South Africa's consumption increased to 83,800 t in 2006 from 82,000 t in 2005 (Maphango, 2007b).

Outlook.—African copper mine production is expected nearly to triple from 2006 to 2013. Congo (Kinshasa) is likely to account for a majority of the increase in output. In 2007, the Frontier and the Kinsevere Mines are expected to open, and the Kamoto and the KOV Mines are scheduled to restart production. The Kalukundi, the Kinsenda, and the Ruashi mines are likely to open in 2008; the Tenke Fungurume Mine, in 2009; and the Kolwezi tailings project, in 2010. Additional sources of higher output include the Kakanda and the Taratara Mines, which are expected to reach full production by 2009. The Lonshi Mine is expected to shut down in 2009, and the Ruashi Tailings project, in 2010. By 2011, the Kamoto and the KOV Mines could reach their full capacity, which is planned to be more than twice the current total copper mine output in Congo (Kinshasa). The Congolese share of African copper production is likely to increase to 40% in 2013 from 16% in 2006 (table 7).

Output is likely to double in Zambia by 2013. The openings of the Chingola and the Lumwana Mines are planned to take place in 2007 and 2009, respectively. The Konkola Deeps project is expected to start in 2009 and to reach full production by 2013. Expansions are planned for the Mufulira, the Mufulira South, and the Nkana Mines in 2007 (table 7).

In Botswana, the Dukwe Mine is expected to open in 2009 and to reach full capacity by 2011. Nevsun Resources Ltd. planned to start mining from a copper-rich zone at the Bisha Mine in Eritrea in 2010. South Africa's production could increase because of higher output from the Palabora Mine and the expansion of the Nkomati nickel mine and the Limpopo and the Northam PGM mines. In Mauritania, the Guelb Moghrein Mine is expected to reach full production in 2011. Tanzania's production is likely to increase with the opening of the Bugwazi gold mine in 2009. The opening of the Tschudi Mine in 2009 is expected to result in higher output in Namibia (table 7).

The production of refined copper is expected to rise by an average of 13% per year from 2006 to 2013. Zambia's production is expected to increase because of higher output from the Mufulira refinery and the Bwana Mkubwa, the Kansanshi, and the Konkola solvent extraction/electrowinning (SX/EW) plants by 2009. The new Chambishi and Chingola South SX/EW plants are likely to open in 2009 and to reach planned capacity by 2011. In Congo (Kinshasa), new SX/EW plants could open at the Ruashi Mine and near the Kamoto and the KOV Mines in late 2008. Additional plants are expected to open at Luita in 2009, and at the Kinsevere Mine and the Kolwezi tailings project by 2010. Congo (Kinshasa), which did not produce refined copper in 2006, could account for nearly 38% of Africa's refined copper output by 2011 (table 8).

Gold.—*Production.*—Africa's gold mine production was about 525,000 kilograms (kg) in 2006, which was a decrease of about 5% compared with that of 2000. Production was considerably less than that of 1995 because of the long-term decline in South African production (table 9). From 1990 to 2006, Africa's share of world gold mine production decreased to about 21% from 32% (table 4).

In South Africa, the decrease in production was broadly based, with output declining from each of the country's five leading gold producers. In Tanzania, lower production from the Geita and the Golden Pride Mines more than offset higher

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production from the Bulyanhulu, the North Mara, and the Tulawaka Mines. In Niger, output declined at the Samira Hill Mine. Production also declined in Ethiopia, Guinea, Sudan, and Zimbabwe (table 9).

Mali's production increased in 2006; higher output from the Kalana, the Loulo, the Sadiola Hill, and the Yatela Mines more than offset lower output from the Morila Mine. Gold production from the Guelb Moghrein copper mine in Mauritania started in December 2006. Output also increased in Botswana, Burkina Faso, Burundi, Cameroon, and Congo (Kinshasa) (table 9).

In 2006, South Africa accounted for 51% of African gold production; Ghana, 12%; Mali, 10%; and Tanzania, 9%. South Africa's share of continental gold production continued to decline from 81% in 1995 because of rising production costs associated with deeper underground operations and increased production in Ghana, Guinea, Mali, and Tanzania (table 9).

Outlook.—Gold mine production in Africa is expected to increase by an average of about 3% per year from 2006 to 2013. The long-term decline in South Africa's production could be reversed because of the reopening of mines in the Central Rand gold fields and the opening of the Burnstone and the Modder East Mines in 2009. The opening of uranium mines that include the Dominion Mine in 2007 and the Buffelsfontein and Ezulwini Mines in 2008 is also likely to contribute to higher gold production. Other new gold projects include the Tshepong Decline project in 2008, the Phakisa Shaft in 2009, and the planned expansion of the Masimong Mine in 2010. The Moab Khotsong Mine, which was producing gold in 2006, is expected to reach full production in 2012; higher production is also planned for the South Deep Mine by 2008. These projects could more than offset lower production from the Great Noligwa Mine and the planned shutdown of the Savuka Mine in 2010 (table 9).

In Ghana, the outlook is for an increase in output because of higher production from the Bibiani Mine by the end of 2008 and the Iduapriem Mine by 2009. Tanzania's production is likely to increase to more than 55 t by 2009 with the opening of the Buckreef Mine in 2008 and the Buzwagi Mine in 2009 and increased production at the North Mara Mine; these increases could more than offset the decreased output at the North Mara Mine and the planned closure of the Tulawaka Mine in 2010. In Mali, the reopening of the Syama Mine is likely in 2008, and the opening of the Tabakoto Mine, in 2009. By March 2008, production is expected to start at the Bonikro gold deposit in Côte d'Ivoire. In Mauritania, Rio Narcea Gold Mines Ltd. plans to start production at the Tasiast Mine by mid-2007. Production could increase in Zimbabwe depending upon the restoration of economic and political stability there (table 9).

Several African countries that had only artisanal gold production in 2006 are likely to open large-scale gold mines in the near future. In Burkina Faso, the Taparko Bourom Mine is expected to open in 2007, and the Kalsaka and the Youga Mines, in 2008. Gold-rich zones in the Bisha Mine in Eritrea are planned to be mined from 2008 to 2010. In Mozambique, production at the Manica gold project could start by 2011. Sudan's only large-scale gold mine is expected to shut down in 2010 (table 9).

Iron and Steel.—*Production.*—African production of crude steel increased by 5% in 2006. Most of the increase was attributable to higher output at the Aladja steel plant in Nigeria. Production increased in Algeria and South Africa and decreased in Libya and Zimbabwe. South Africa accounted for 52% of regional crude steel production; Egypt, 29%; and Algeria and Libya, 6% each (table 11). Africa's share of world crude steel production amounted to 2% in 2006 (table 4).

South Africa produced about 7.51 Mt of hot-rolled steel products in 2006; Egypt, 6.42 Mt; and Morocco, 0.96 Mt. Other African producers of hot-rolled steel products included Algeria, Libya, and Tunisia (International Iron and Steel Institute Committee on Economic Studies, 2007, p. 48).

Consumption.—In 2006, world crude steel consumption increased to 1.24 billion metric tons (Gt) from 1.13 Gt in 2005. African crude steel consumption increased to nearly 29.2 Mt in 2006 from 25.6 Mt in 2005. Egypt and South Africa accounted for 23% each of African crude steel demand; Algeria, 14%; Morocco, 6%; Nigeria, 5%; and Libya and Tunisia, 4% each (International Iron and Steel Institute Committee on Economic Studies, 2007, p. 78-79).

Outlook.—Crude steel production is expected to rise by an average of about 4% per year from 2006 to 2013. Nigeria, which accounted for less than 1% of African crude steel output in 2005, could increase its share to 10% by 2013 with the opening of the Ajaokuta plant and increased production at the Delta plant. In South Africa, the expansion of the Vanderbijlpark plant is scheduled to take place from 2007 to 2009. In Algeria, increased utilization of existing capacity is expected to raise national steel production to 2.5 Mt by 2011. Libya's output was also likely to increase. Production could increase in Zimbabwe as Zimbabwe Iron and Steel Company restores its capacity; improvement in this company's situation depends upon the restoration of economic and political stability (table 11).

Iron Ore.—*Production.*—In 2006, the iron content of ore produced in Africa amounted to 36.3 Mt compared with 34.6 Mt in 2005. Production increased in Algeria, Mauritania, and South Africa in 2006. South Africa was the leading iron ore producer in Africa and accounted for 72% of continental output; Mauritania, 20%; and Egypt, 4% (table 10).

Outlook.—The iron content of ore produced in Africa is expected to increase to almost 63 Mt in 2013 (table 10). In South Africa, the expansion of the Sishen Mine is likely to be completed in 2009; a further expansion of the mine could be completed by 2013. Production at the Bruce, the King, and the Mokaning Mines (BKM) could start in 2008 and reach full capacity in 2010. The opening of BKM would more than offset the expected decline in output from the Beeshok Mine after 2008. The Faleme iron ore project in Senegal could start production in 2011. In Nigeria, production at the Ajaybanko and the Itakpe iron ore deposits is expected to reach full capacity by 2013. Output is expected to decrease in Algeria and Egypt and to cease in Tunisia (table 10).

Lead.—*Production.*—From 2005 to 2006, African lead mine production decreased by 2%. In South Africa, output increased at the Black Mountain Mine. Production also increased in Morocco. Tunisia's production ceased in 2005 because of the shutdown of the Bougrine Mine. In Namibia, output declined at the Rosh Pinah Mine because of labor disputes. In 2006, South Africa accounted for 46% of African lead mine production;

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Morocco, 43%; and Namibia, 11% (table 12). Africa's share of the world's lead mine production was about 3% in 2006 (table 4).

African production of refined lead increased by 12% compared with that of 2005; output increased in Morocco and South Africa. South Africa accounted for 54% of African refined lead output; and Morocco, 37% (table 13).

Consumption.—In 2006, world refined lead consumption increased to 7.95 Mt from 7.88 Mt in 2005. South African lead consumption increased to 75,000 t in 2006 from 74,500 t in 2005 (Pitso, 2007).

Outlook.—The decline in African lead mine production is likely to continue, with output expected to decline by 9% from 2006 to 2013. Most of the decrease would be attributable to the closure of the Rosh Pinah Mine in Namibia by 2013; production is also expected to decrease in Morocco (table 12). Refined lead production is likely to decline by 12% by 2011 (table 13).

Nickel.—*Production.*—African mine production of nickel decreased by 2% in 2006. Output declined in Botswana and South Africa and increased in Zimbabwe. Most of South Africa's nickel output was a coproduct of PGM mining. In 2006, South Africa accounted for 47% of African nickel mine output; Botswana, 43%; and Zimbabwe, 10% (table 14). Minor tonnages of nickel were recovered as a byproduct of cobalt operations in Morocco.

Outlook.—Nickel mine production is likely to double from 2006 to 2013. The startup of the Ambatovy nickel and cobalt mine in 2010 in Madagascar is expected to account for the majority of the increase. Madagascar, which did not mine nickel in 2006, could have a 34% share of African nickel mine production in 2013. Higher output is expected in South Africa because of increased capacity at the Nkomati nickel mine and the Limpopo, the Marikana, and the Northam PGM mines. In Zambia, Albidon Ltd. planned to start production from the Munali project in the first half of 2008. The Nkamouna cobalt, manganese, and nickel mine is likely to open in Cameroon in 2010. Output is expected to decline in Zimbabwe. Botswana's production is likely to decline because of the planned closure of the Selebi-Phikwe Mine in 2011 or 2012 (table 14).

Platinum-Group Metals.—*Production.*—From 2005 to 2006, Africa's production of palladium and platinum increased by 4% and 3%, respectively. South African production increased because of higher output from the Eastern Platinum, the Everest, the Karee, and the Western Platinum Mines. Production also increased in Zimbabwe. South Africa, which was the continent's dominant producer of platinum-group metals (PGM) in Africa, accounted for 97% and 96% of the production of platinum and palladium, respectively (tables 15, 16).

Outlook.—African mine production of palladium is expected to increase by an average of between 6% and 7% per year from 2006 to 2013, and platinum, by between 5% and 6% per year. In South Africa, the increase is likely to be attributable to the opening of the Smokey River Mine in 2007, the Blue Ridge Mine in 2008, the Kalahari Mine and the Pilansberg project in 2009, the Project 1 and the Leeuwkop Mines in 2010, and the Pandora Mine in 2012. Expansions are planned to be completed at the Marula and the PPRust Mines in 2009; the Nkomati and the Western Platinum Mines in 2010; and the Amandelbult, the Lebowa, the Limpopo, and the Northam Mines in 2012. The Everest and the Marikana Mines are expected to reach full capacity in 2007, and the Mototolo and the Two Rivers Mines, in 2008. Higher output in Zimbabwe is likely to result from the expansion of the Mimosa and the Ngezi Mines and the opening of the Unki Mine in 2009 (tables 15, 16).

Zinc.—*Production.*—From 2005 to 2006, Africa's mine production of zinc declined by about 14%. Tunisia's production ceased in 2005 because of the shutdown of the Bougrine Mine. In Namibia, output declined at the Rosh Pinah Mine because of labor disputes. Production also declined in Algeria and Morocco. In South Africa, output increased at the Black Mountain Mine. Production increased sharply at Slag Treatment Plant Lubumbashi in Congo (Kinshasa). In 2006, Morocco accounted for 40% of African zinc mine production; Namibia, 31%; South Africa, 19%; and Congo (Kinshasa), 9% (table 17). Africa's share of world zinc mine production was about 2% in 2006 (table 4).

African production of zinc metal decreased by nearly 6% compared with that of 2005. Production declined at the Skorpion smelter in Namibia because of a fire. In South Africa, output declined because of lower-quality concentrates from the refinery's main suppliers. Namibia, which did not produce zinc metal before 2003, accounted for 52% of continental zinc metal production in 2006. South Africa's share declined to 36% in 2006 from 75% in 2000, and Algeria's share, to 12% from 25% (table 18).

Consumption.—In 2005, world refined zinc consumption remained nearly unchanged at about 10.3 Mt. South African zinc consumption increased to 103,000 t in 2005 from 91,000 t in 2004 (Maphango, 2006).

Outlook.—African zinc mine production is expected to increase by 41% from 2006 to 2009 before decreasing by 13% from 2009 to 2013. The Perkoa zinc project in Burkina Faso is expected to start production in 2008. Burkina Faso, which did not mine zinc in 2006, could account for 31% of continental zinc production in 2013. The Rosh Pinah Mine is expected to close by 2013. In Congo (Kinshasa), the proposed reopening of the Kipushi Mine could lead to further increases in production, but whether this project will be implemented by the end of 2013 is uncertain (table 17).

Regional production of zinc metal could increase by nearly 20% by 2009. The Zincor smelter is expected to increase production by 33% by the end of 2007 because of debottlenecking operations. Higher production from the Skorpion smelter in Namibia is also likely (table 18).

Industrial Minerals

Diamond.—*Production.*—In 2006, Africa's share of world diamond production, by volume, was 53% (table 4). African diamond production decreased by nearly 2% in 2006 compared with that of 2005. Congo (Kinshasa) accounted for most of the decline in production, by volume. Sociètè Minièrè de Bakwanga (MIBA) experienced a sharp decline in production, which was partially attributable to conflict between MIBA and artisanal miners who reportedly made incursions onto the company's property. Sengamines shut down mining operations

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in 2005 because of fuel delivery problems. Artisanal diamond production also declined in 2006. Lower output in South Africa was attributable to the Cullinan and the Venetia Mines. Diamond production also declined in Ghana, Guinea, Sierra Leone, and Togo (table 19).

Most of the increase in Botswana's diamond production was attributable to the Orapa Mine. In Zimbabwe, production quadrupled because of a diamond rush by artisanal miners in the Marange area. Tanzania's production also increased in 2006 because of small-scale and artisanal miners. In Namibia, higher production was attributable to Namdeb Diamond Corporation (Pty) Ltd.'s increased output. Botswana accounted for 37% of African diamond output by volume; Congo (Kinshasa), 30%; South Africa, 16%; and Angola, 10% (table 19).

In 2006, the global value of rough diamond production amounted to $12.5 billion, of which Africa accounted for about 60%. Botswana accounted for 27% of the value of global rough diamond output; Angola, 12%; South Africa, 10%; Namibia, 6%; and Congo (Kinshasa), 4% (Hinde, 2007).

In November 2002, the Kimberley Process Certification Scheme (KPCS) was established to reduce the trade in conflict diamond, particularly diamond originating from Angola, Congo (Kinshasa), and Sierra Leone. The establishment of the KPCS involved Government officials from more than 50 countries that produced, processed, and imported diamond as well as representatives from the European Union, the World Diamond Council, and nongovernmental organizations. As of 2006, the following African countries had met the minimum requirements of the KPCS: Angola, Botswana, Central African Republic, Congo (Kinshasa), Ghana, Guinea, Lesotho, Mauritius, Namibia, Sierra Leone, South Africa, Swaziland, Tanzania, Togo, and Zimbabwe.

Kimberley Process efforts to control illicit diamond production focused on Côte d'Ivoire and Liberia in 2006. In December 2005, the United Nations Security Council banned the importation of rough diamond from Côte d'Ivoire because of the alleged link between illegal diamond mining and the country's unresolved armed conflict (United Nations Security Council, 2005).

Outlook.—The production of rough diamond is expected to increase by an average of 1% per year from 2006 to 2013. The expansion of Namdeb's operations in Namibia is expected to account for most of the increase. In South Africa, DeBeers plans to open its marine operations in 2007, and the Voorspoed Mine, in 2009. The company also expects to increase production at the Finsch Mine in 2007. Petra Diamonds Ltd. plans nearly to triple production at the Helam, the Koffiefontein, the Sedibeng, and the Star Mines by 2010. In Tanzania, DeBeers plans to increase output at the Williamson Mine to 500,000 carats per year by the end of 2008. Lesotho's production is expected to increase because of higher output at the Letseng and the Lighobong Mines. Higher output is also likely in Angola and Guinea (table 19).

Production at MIBA's facilities in Congo (Kinshasa) is expected to decline to less than 1 million carats in 2007. Output is also likely to decline in Zimbabwe as near-surface resources are depleted at the Murowa Mine (table 19).

Phosphate Rock.—*Production.*—In 2006, the diphosphorus pentoxide (P_2O_5) content of African phosphate rock production amounted to about 14.4 Mt compared with 14.5 Mt in 2005. Higher production in Algeria and Togo was more than offset by lower production in Morocco, Senegal, and Tunisia. Morocco, which was the leading producer of phosphate rock in Africa, accounted for 63% of continental phosphate rock output in 2006; Tunisia, 17%; and South Africa, 7% (table 20).

Outlook.—The P_2O_5 content of African phosphate rock production is expected to increase to nearly 14.7 Mt by 2011. In Morocco, Office Cherifien des Phosphates could complete an expansion by 2009. Production is expected to decline in Algeria and Tunisia (table 20).

Mineral Fuels and Related Materials

Coal.—*Production.*—African coal production remained nearly unchanged in 2006. In South Africa, higher production at the Boschmans, the Goedhoop, the Isibonelo, the New Denmark, and the Waterpan Mines was offset by lower production from the Bank, the Douglas, the Middleburg, the New Vaal, and the Twistdraai Mines. Output increased in Malawi, Mozambique, and Swaziland and decreased in Botswana, Niger, Tanzania, Zambia, and Zimbabwe. South Africa, which was the dominant coal producer in Africa, accounted for 98% of regional coal output; Zimbabwe, 1%; and others, less than 1% (table 21). More than 99% of South Africa's coal production was bituminous. Africa accounted for about 5% of total world anthracite and bituminous coal production in 2006.

Consumption.—Africa accounted for about 3% of world coal consumption in 2006. Within the region, South Africa accounted for 92% of African coal consumption. From 2001 to 2006, Africa's consumption of coal increased by about 15% (British Petroleum plc, 2007, p. 35).

Outlook.—African coal production is expected to increase by between 3% and 4% per year from 2006 to 2013. South Africa is likely to be responsible for the majority of the increase; its production could increase to 295 Mt by 2013 (table 21). Higher output would be attributable to the opening of the Belfast and the Inyanda Mines in 2008; the Holfontein, the Mooiplaats, the Tumelo, and the Zongdagsfontein Mines in 2009; the Elders Opencast Mine in 2011; and the Elders Underground and the Heidelberg Underground Mines in 2013; and to the expansions of the Mafube Mine in 2008, the Forzando South Mine in 2009, and the Goedgevonden and the Grootegeluk Mines in 2010 (table 21).

Mozambique is expected to become the second ranked coal producer in Africa with the development of the Moatize project in 2010. Botswana is likely to become the third ranked producer because of the expansion of the Morupule Colliery in 2008 and the start of production at the Mmamabula East project in 2011. In Zimbabwe, output could increase at Hwange Colliery by 2011 if economic and political stability are restored. Production is also expected to increase in Tanzania with the expansion of the Kiwira Mine in 2007 (table 21).

Uranium.—*Production.*—In 2006, African uranium mine production increased by 2% compared with that of 2005. Higher output in Niger more than offset lower output in Namibia and South Africa. In Namibia, production declined at the Rossing Mine, and the Langer Heinrich Mine opened in late

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December 2006. South Africa's production declined because of lower output from gold mines. Namibia accounted for 49% of African uranium production; Niger, 44%; and South Africa, less than 8% (table 22). Africa accounted for about 19% of the world's uranium production in 2005 (table 4).

Consumption.—South Africa was the only regional consumer of uranium in 2006. Africa accounted for less than 1% of the electricity generated worldwide by nuclear power (British Petroleum plc, 2007, p. 36).

Outlook.—Continental uranium mine production is expected to rise by 10% per year from 2005 to 2011. Namibia is expected to account for the majority of the increase. Declining production from the Rossing Mine by 2013 is likely to be more than offset by increased production from the Langer Heinrich Mine, which is scheduled to reach full capacity by 2009, and the opening of the new Trekkopje and Valencia Mines by 2011. The Goanikontes Mine is also expected to open in 2013. In South Africa, the Dominion Mine is expected to open in 2007, and the Buffelsfontein and the Ezulwini Mines, in 2008. AngloGold Ashanti Ltd. planned to increase uranium output from its South African gold mines by 40% by late 2008. The Kayelekera Mine in Malawi is expected to start production in the third quarter of 2008 (table 22; Mining Review Africa, 2007).

Trade Review and Outlook

Africa's current account surplus amounted to 2.2% of the GDP in 2006 compared with 1.8% of the GDP in 2005. In 2006, sub-Saharan countries ran an average deficit of 1.3% of the GDP, and countries in the Arab Maghreb Union ran an average surplus of 14.4% of the GDP. Trade surpluses in oil-exporting countries more than offset trade deficits in oil-importing countries. Oil-importing countries had an average current account deficit of 4.2% of the GDP in 2006, and oil-exporting countries had an average current account surplus of 12.6% of the GDP (International Monetary Fund, 2007, p. 75).

Out of 33 African nations for which information was available, 20 countries experienced a decline in their terms of trade from 2002 to 2005 and 13 experienced an improvement. The countries that experienced the worst decline in their terms of trade were oil importers. However, Botswana's terms of trade improved because higher prices for oil imports were more than offset by higher prices for diamond exports. Similar reasoning held for Mozambique because of higher prices for aluminum; in Niger, for uranium; and in Zambia, for copper (International Monetary Fund, 2006, p. 65, 67).

The average current account deficit for oil-importing countries is expected to be 4.4% of the GDP in 2007 and 4.2% of the GDP in 2008. For oil-exporting countries, the surplus is predicted to decline to 7.6% of the GDP in 2007 and 6.8% of the GDP in 2008. Africa is expected to run a current account surplus of 0.1% of the GDP in 2007 and to have balanced trade in 2008 (International Monetary Fund, 2007, p. 75).

In 2005 or 2006, minerals and mineral fuels accounted for more than 90% of the export earnings of Algeria (which were mainly, in order of value, petroleum and natural gas), Congo (Brazzaville) (petroleum), Congo (Kinshasa) (diamond, petroleum, cobalt, copper, and gold), Equatorial Guinea (petroleum), Libya (petroleum and natural gas), Nigeria (petroleum and natural gas), and Sudan (petroleum and gold). Minerals and mineral fuels accounted for more than 80% of the export earnings of Botswana (diamond, nickel, copper, soda ash, and gold), Chad (petroleum), Gabon (petroleum and manganese), Guinea (bauxite, gold, alumina, and diamond), Sierra Leone (diamond, bauxite, rutile, and ilmenite), and Zambia (copper and cobalt). Minerals and mineral fuels accounted for more than 50% of the export earnings of Mali (gold), Mauritania (iron ore), Mozambique (aluminum), Namibia (diamond, uranium, zinc, gold, and copper). Gold was also a significant source of export earnings in Ghana, South Africa, and Tanzania. Diamond was a significant source of export earnings in the Central African Republic and South Africa, as was uranium in Niger (International Monetary Fund, 2008a, p. 38; 2008b, p. 84-85; 2008c, p. 28).

Africa's natural gas exporters included Algeria, which accounted for 59% of the continent's natural gas exports; Nigeria, 17%; Egypt, 16%; and Libya, 8%. Europe received 87% of African total natural gas exports and was the destination for 93% of Africa's natural gas exports by pipeline and 82% of Africa's liquefied natural gas (LNG) exports. The United States received 11% of Africa's LNG exports, and countries of the Asia and the Pacific region, 7% (British Petroleum plc, 2007, p. 30).

In 2006, Europe received 34% of Africa's petroleum exports; the United States, 33%; China, 11%; Japan, 2%; and other countries in the Asia and the Pacific region, 14%. West African countries sent 41% of their exports to the United States and 38% to China, Japan, and other countries in the Asia and the Pacific region. North African countries sent 60% of their exports to Europe and 23% to the United States. Intraregional exports to African countries amounted to only 1% of total African petroleum exports (British Petroleum plc, 2007, p. 20).

Intraregional minerals trade was, however, significant for gold. South Africa imported more than 150,000 kg of gold, mostly from West African countries, to supply its gold refinery. A majority of African gold mine production was refined in South Africa prior to export to other regions. Most of Africa's copper and PGM production was also exported in refined form. The majority of Africa's chromite production was processed into ferrochromium prior to export. For other commodities, which included bauxite, colored gemstones, diamond, iron ore, petroleum, and uranium, most of or all of the continent's production was exported prior to downstream processing.

Environment

Deforestation for fuel use and land-intensive agricultural production continued to be a significant environmental issue in many African countries. Other causes of deforestation included artisanal production of gemstones, lime, and sand and gravel. The use of mercury by artisanal gold miners has led to serious air and water pollution in such African countries as Ghana, Kenya, Mozambique, South Africa, Sudan, Tanzania, and Zimbabwe. The flaring of natural gas in Nigeria has led to air pollution and emissions of greenhouse gases.

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TABLE 1

AFRICA: AREAL EXTENT AND ESTIMATED POPULATION IN 2006[1]

Country	Area[2] (square kilometers)	Estimated population[3] (millions)
Algeria	2,381,740	33.4
Angola	1,246,700	16.6
Benin	112,620	8.8
Botswana	600,370	1.9
Burkina Faso	274,200	14.4
Burundi	27,830	8.2
Cameroon	475,440	18.2
Cape Verde	4,033	0.5
Central African Republic	622,984	4.3
Chad	1,284,200	10.5
Comoros	2,170	0.6
Congo (Brazzaville)	342,000	3.7
Congo (Kinshasha)	2,345,410	60.6
Côte d'Ivoire	322,460	18.9
Djibouti	23,000	0.8

See footnotes at end of table.

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TABLE 1--Continued

AFRICA: AREAL EXTENT AND ESTIMATED POPULATION IN 2006[1]

Country	Area[2] (square kilometers)	Estimated population[3] (millions)
Egypt	1,001,450	74.2
Equatorial Guinea	28,051	0.5
Eritrea	121,320	4.7
Ethiopia	1,127,127	77.2
Gabon	267,667	1.3
Gambia, The	11,300	1.7
Ghana	239,460	23.0
Guinea	245,857	9.2
Guinea-Bissau	36,120	1.6
Kenya	582,650	36.6
Lesotho	30,355	2.0
Liberia	111,370	3.6
Libya	1,759,540	6.0
Madagascar	587,040	19.2
Malawi	118,480	13.6
Mali	1,240,000	12.0
Mauritania	1,030,700	3.0
Mauritius	2,040[4]	1.3
Morocco	712,550	30.7
Mozambique	801,590	21.0
Namibia	825,418	2.0
Niger	1,267,000	13.7
Nigeria	923,768	145
Reunion	2,517	NA
Rwanda	26,338	9.5
Sao Tome e Principe	1,001	0.2
Senegal	196,190	12.1
Seychelles	455	0.1
Sierra Leone	71,740	5.7
Somalia	637,657	8.4
South Africa	1,219,912	47.4
Sudan	2,505,810	37.7
Swaziland	17,363	1.1
Tanzania	945,087	39.5
Togo	56,785	6.4
Tunisia	163,610	10.1
Uganda	236,040	29.9
Zambia	752,614	11.7
Zimbabwe	390,580	13.2
Total	30,359,709	937
United States[5]	9,631,418[5]	299
World	148,940,000	6,540

NA Not Available.

[1]Includes data available through May 2008. Population estimates are rounded to no more than three significant digits.

[2]Source: U.S. Central Intelligence Agency, World Factbook 2007.

[3]Source: World Bank 2008, World Development Indicators Database.

[4]Includes Agalega Islands, Cargados Carajos Shoals (Saint Brandon), and Rodriguez.

[5]Includes only the 50 States and the District of Columbia.

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TABLE 2
AFRICA: GROSS DOMESTIC PRODUCT IN 2006[1, 2, 3]

Country	Estimated gross domestic product (billions)	Estimated gross domestic product per capita	Real gross domestic annual percentage change
Algeria	$209.3	$6,192	2.0%
Angola	73.4	4,627	18.6%
Benin	11.3	1,485	3.8%
Botswana	23.7	15,073	3.6%
Burkina Faso	16.1	1,199	5.5%
Burundi	2.7	356	5.1%
Cameroon	37.1	2,024	3.2%
Cape Verde	1.5	3,010	10.8%
Central African Republic	2.9	692	4.0%
Chad	15.4	1,662	0.2%
Comoros	0.7	1,130	1.2%
Congo (Brazzaville)	13.1	3,798	6.2%
Congo (Kinshasa)	17.3	291	5.6%
Côte d'Ivoire	30.8	1,669	-0.3%
Djibouti	1.6	2,154	4.8%
Egypt	367.4	5,094	6.8%
Equatorial Guinea	13.5	11,493	-5.6% [4]
Eritrea	3.5	767	-1.0%
Ethiopia	54.4	724	11.6%
Gabon	18.6	13,321	1.2%
Gambia, The	1.9	1,238	6.5%
Ghana	28.7	1,339	6.4%
Guinea	10.3	1,064	2.2%
Guinea-Bissau	0.8	473	1.8%
Kenya	53.6	1,574	6.1%
Lesotho	2.9	1,215	7.2%
Liberia	1.2	333	7.8%
Libya	68.2	11,421	5.2%
Madagascar	16.6	1,005	5.0%
Malawi	9.5	727	7.9%
Mali	12.8	1,002	5.3%
Mauritania	5.7	1,984	11.4%
Mauritius	13.1	10,465	3.6%
Morocco	119.4	3,922	8.0%
Mozambique	15.5	773	8.0%
Namibia	10.0	4,881	4.1%
Niger	8.4	649	5.2%
Nigeria	268.0	1,915	6.2%
Reunion	NA	NA	NA
Rwanda	7.8	843	5.5%
Sao Tome e Principe	0.2	1,470	6.7%
Senegal	19.1	1,600	2.1%
Seychelles	1.3	15,409	5.3%
Sierra Leone	3.6	647	7.4%
Somalia	5.0 [5]	600 [5]	2.6% [5]
South Africa	432.7	9,113	5.4%
Sudan	71.1	1,964	11.3%
Swaziland	5.4	4,671	2.8%
Tanzania	44.4	1,163	6.7%
Togo	5.0	788	4.1%
Tunisia	70.5	6,934	5.5%
Uganda	26.6	889	5.1%
Zambia	14.7	1,241	6.2%

See footnotes at end of table

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TABLE 2--Continued
AFRICA: GROSS DOMESTIC PRODUCT IN 2006[1, 2, 3]

Country	Estimated gross domestic product (billions)	Estimated gross domestic product per capita	Real gross domestic annual percentage change
Zimbabwe	2.3	195	-5.4%
Total	2,271	170,266	NA
United States[6]	13,195	44,118	2.9%
World	60,295	XX	3.9%

NA Not available. XX Not applicable.

[1]Source: International Monetary Fund, World Economic Outlook Database, April 2008.

[2]Table data compiled May 2008. Gross domestic product may differ from that reported in individual country chapters of the 2006 Minerals Yearbook owing to differences in source or date of reporting.

[3]Gross domestic product based on purchasing power parity.

[4]2003 estimate.

[5]Source: U.S. Central Intelligence Agency, World Factbook 2007.

[6]Includes only the 50 States and the District of Columbia.

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TABLE 3
SELECTED SIGNIFICANT AFRICAN EXPLORATION SITES IN 2006

Country	Type[1]	Site	Commodity[2]	Company	Resource[2, 3]	Exploration[4]
Botswana	E	Selkirk	Ni, Cu	LionOre Mining International Ltd.	469,000 t Ni, 401,000 t Cu	Extensive drilling.
Burkina Faso	E	Belahouro/Inata	Au	Goldbelt Resources Ltd.	948,000 oz Au	Do.
Do.	E	Bissa	Au	High River Gold Mines Ltd.	662,000 oz Au	Do.
Do.	E	Essakan	Au	Orezone Resources Inc.	1.9 Moz Au	Extensive work program.
Central African Republic	F	Passendro	Au	Axmin, Inc.	1.56 Moz Au	Extensive drilling.
Congo (Kinshasa)	F	Kinsevere	Cu	Anvil Mining Ltd.	865,000 t Cu	Do.
Do.	E	Moto	Au	Moto Goldmines Ltd.	6.1 Moz Au	Do.
Do.	E	Twangiza	Au	Banro Corp.	3 Moz Au	Do.
Egypt	F	Sukari	Au	Centramin Egypt Ltd.	7.5 Moz Au	Feasibility drilling.
Ghana	P	Chirano/Akwaaba	Au	Red Back Mining Inc.	674,000 oz Au	Extensive drilling.
Do.	F	Southern Ashanti	Au	Adamus Resources Ltd.	1.5 Moz Au	Do.
Guinea	P	Dinguiraye/Lero	Au	Crew Gold Corp.	2.5 Moz Au	Do.
Mali	E	Foulbaba-Tiekoumala (FT)	Au	North Atlantic Resources Ltd.	160,000 oz Au	Do.
Mauritania	F	Guelb el Aouj	Fe	Sphere Investments Ltd.	226 Mt Fe	Do.
Senegal	F	Grande Côte	heavy minerals	Mineral Deposits Ltd.	20 Mt heavy minerals	Do.
Do.	F	Sabodala	Au	do.	2.2 Moz Au	Do.
South Africa	E	Akanani	PGM, Au, Ni, Cu	AfriOre Ltd.	(5)	Do.
Tanzania	E	Singida	Au	Shanta Gold Ltd.	Data not released.	Do.
Zambia	E	Cheowa/Chakwenga	Cu, Au	Zambezi Resources Ltd.	do.	Do.
Zimbabwe	E	Pickstone-Peerless	Au	African Consolidated Resources plc.	820,000 oz Au	Do.

[1]E--Active exploration; F--Feasibility work ongoing or completed; P--Exploration at producing site.

[2]Abbreviations used in this table for commodities include the following: Au--gold; Cu--copper; Fe--Iron; Ni--nickel; and PGM--platinum-group metals.

Abbreviations used in this table for units of measure include the following: Moz--million troy ounces; Mt--million metric tons; oz--troy ounces; t--metric tons

[3]Based on 2005 data reported from various sources; values vary from measured reserves to identified resources. Data not verified by the U.S. Geological Survey.

[4]Sites where extensive (greater than 10,000 meters) drilling or significant (more than $5 million) expenditures have been reported.

[5]Resource includes 16 Moz platinum, 14 Moz palladium, 1.6 Moz rhodium, 1.6 Moz gold, 598,000 t nickel, 349,000 t copper.

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TABLE 4

AFRICA: PRODUCTION OF SELECTED MINERAL COMMODITIES IN 2006[1]

(Thousand metric tons unless otherwise specified)

Country	Aluminum		Metals				Iron and steel		Lead,	Manganese
	Bauxite	Metal[2]	Chromite, mine output, gross weight	Cobalt, mine output, Co content (metric tons)	Copper, mine output, Cu content	Gold, mine output (kilograms)	Iron ore, gross weight	Steel, crude	mine output, Pb content (metric tons)	ore, mine output, Mn content
Algeria	--	--	--	--	--	377 p	2,340 p	1,200 p	--	--
Angola	--	--	--	--	--	--	--	--	--	--
Benin	--	--	--	--	--	20 e	--	--	--	--
Botswana	--	--	--	--	24	3,020	--	--	--	--
Burkina Faso	--	--	--	--	--	1,571	--	--	--	--
Burundi	--	--	--	--	--	4,313	--	--	--	--
Cameroon	--	87 e	--	--	--	20,000 e	--	--	--	--
Cape Verde	--	--	--	--	--	--	--	--	--	--
Central African Republic	--	--	--	--	--	10 e	--	--	--	--
Chad	--	--	--	--	--	150 e	--	--	--	--
Comoros	--	--	--	--	--	--	--	--	--	--
Congo (Brazzaville)	--	--	--	--	--	100 e	--	--	--	--
Congo (Kinshasa)	--	--	--	28,400	130 e	10,000 e	--	104	--	--
Côte d'Ivoire	--	--	--	--	--	1,324	--	--	--	--
Djibouti	--	--	--	--	--	--	--	--	--	--
Egypt	--	252	--	--	--	--	1,600 p	5,500 p	--	7
Equatorial Guinea	--	--	--	--	--	200 e	--	--	--	--
Eritrea	--	--	--	--	--	25 e	--	--	--	--
Ethiopia	--	--	--	--	--	4,028	--	60 e	--	--
Gabon	--	--	--	--	--	300 e	--	--	--	1,350
Gambia, The	--	--	--	--	--	--	--	--	--	--
Ghana	842	36 e	--	--	--	66,205	--	-- e	--	560 e
Guinea	16,956	--	--	--	--	18,147	--	--	--	--
Guinea-Bissau	--	--	--	--	--	--	--	--	--	--
Kenya	--	2 e	--	--	--	432	(3)	--	--	--
Lesotho	--	--	--	--	--	--	--	--	--	--
Liberia	--	--	--	--	--	11 e	--	--	--	--
Libya	--	--	--	--	--	--	--	1,158	--	--
Madagascar	--	--	132	--	--	5 e	--	--	--	--
Malawi	--	--	--	--	--	--	--	--	--	--
Mali	--	--	--	--	--	51,957	--	--	--	--
Mauritania	--	--	--	--	5	322	11,155 e	1 e	--	--
Mauritius	--	--	--	--	--	--	--	--	--	--

See footnotes at end of table.

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TABLE 4--Continued

AFRICA: PRODUCTION OF SELECTED MINERAL COMMODITIES IN 2006[1]

(Thousand metric tons unless otherwise specified)

			Metals--Continued							
	Aluminum			Cobalt,			Iron and steel		Lead,	Manganese
Country	Bauxite	Metal[2]	Chromite, mine output, gross weight	mine output, Co content (metric tons)	Copper, mine output, Cu content	Gold, mine output (kilograms)	Iron ore, gross weight	Steel, crude	mine output, Pb content (metric tons)	ore, mine output, Mn content
Morocco and Western Sahara	--	--	--	1,100 e	3 e	1,800 e	8	5 e	45,000 e	9
Mozambique	12	564 e	--	--	--	68 e	--	--	--	--
Namibia	--	--	--	--	6	2,790	--	--	11,830	9
Niger	--	--	--	--	--	2,615	--	--	--	--
Nigeria	--	--	--	--	--	40 e	--	900 e	(3)	--
Reunion	--	--	--	--	--	--	--	--	--	--
Rwanda	--	--	--	--	--	--	--	--	--	--
Sao Tome e Principe	--	--	--	--	--	--	--	--	--	--
Senegal	--	--	--	--	--	600 e	--	--	--	--
Seychelles	--	--	--	--	--	--	--	--	--	--
Sierra Leone	1,072	--	--	--	--	71	--	--	--	--
Somalia	--	--	--	--	--	--	--	--	--	--
South Africa	--	895 p	7,418 p	400 e	100 e	272,128 p	41,326 p	9,721 p	48,273 p	2,300 p
Sudan	--	--	22 e	--	--	3,158	--	--	--	--
Swaziland	--	--	--	--	--	--	--	--	--	--
Tanzania	--	--	--	--	3	47,000	--	--	--	--
Togo	--	--	--	--	--	--	--	--	--	--
Tunisia	--	--	--	--	--	--	214 p	68 p	--	--
Uganda	--	--	--	--	--	50 e	(3)	5 e	--	--
Zambia	--	--	--	8,000 e	514 e	800 e	--	--	--	--
Zimbabwe	--	--	700 p	26 p	3 p	11,354	104 p	60	--	--
Total	18,900	1,840	8,270	37,900	788	525,000	56,700	18,800	105,000	4,230
Share of world total	10%	4%	44%	58%	5%	21%	3%	2%	3%	35%
United States	NA	2,280	--	--	1,200	252,000	52,700	98,200	429,000	--
Share of world total	NA	5%	--	--	8%	10%	3%	8%	12%	--
World total	190,000	41,800	18,700	65,700	15,200	2,450,000	1,830,000	1,240,000	3,660,000	12,200

See footnotes at end of table.

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TABLE 4--Continued

AFRICA: PRODUCTION OF SELECTED MINERAL COMMODITIES IN 2006[1]

(Thousand metric tons unless otherwise specified)

	Industrial minerals						Mineral fuels	
Country	Zinc, mine output, Zn content (metric tons)	Cement, hydraulic	Diamond, natural (thousand carats)[4]	Graphite (metric tons)	Phosphate rock, gross weight	Coal, anthracite and bituminous	Petroleum, crude (thousand 42-gallon barrels)	Uranium, U_3O_8 content (metric tons)
Algeria	572 [p]	15,000	--	--	1,510	--	619,294	--
Angola	--	1,373	9,175 [5,6]	--	--	--	513,560	--
Benin	--	250 [e]	--	--	--	--	--	--
Botswana	--	--	34,293 [7]	--	--	962	--	--
Burkina Faso	--	30 [e]	--	--	2 [e]	--	--	--
Burundi	--	--	--	--	--	--	--	--
Cameroon	--	1,000 [e]	12 [e]	--	--	--	22,000 [e]	--
Cape Verde	--	--	--	--	--	--	--	--
Central African Republic	--	--	420	--	--	--	--	--
Chad	--	--	--	--	--	--	55,900 [e]	--
Comoros	--	--	--	--	--	--	--	--
Congo (Brazzaville)	--	100 [e]	50 [e]	--	--	--	93,261	--
Congo (Kinshasa)	16,500	530	28,540	--	--	1 [e]	9,000	--
Côte d'Ivoire	--	650 [e]	300 [e]	--	--	--	21,900	--
Djibouti	--	--	--	--	--	--	--	--
Egypt	--	29,000	--	--	2,200	75 [e]	220,000 [e]	--
Equatorial Guinea	--	--	--	--	--	--	145,000 [e]	--
Eritrea	--	45 [e]	--	--	--	--	--	--
Ethiopia	--	1,700 [e]	--	--	--	--	--	--
Gabon	--	260 [e]	1	--	--	--	84,738	--
Gambia, The	--	--	--	--	--	--	--	--
Ghana	--	1,900 [e]	973	--	--	--	--	--
Guinea	--	360	474	--	--	--	--	--
Guinea-Bissau	--	--	--	--	--	--	--	--
Kenya	--	2,200 [e]	--	--	--	--	--	--
Lesotho	--	--	37 [e]	--	--	--	--	--
Liberia	--	155 [e]	NA [e]	--	--	--	--	--
Libya	--	3,600 [e]	--	--	--	--	660,000 [e]	--
Madagascar	--	150 [e]	--	15,000 [e]	--	--	--	--
Malawi	--	200 [e]	--	--	--	48	--	--
Mali	--	--	--	--	--	--	--	--
Mauritania	--	374	--	--	--	--	11,170	--

See footnotes at end of table.

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TABLE 4--Continued

AFRICA: PRODUCTION OF SELECTED MINERAL COMMODITIES IN 2006[1]

(Thousand metric tons unless otherwise specified)

	Industrial minerals					Mineral fuels		
Country	Zinc, mine output, Zn content (metric tons)	Cement, hydraulic	Diamond, natural (thousand carats)[4]	Graphite (metric tons)	Phosphate rock, gross weight	Coal, anthracite and bituminous	Petroleum, crude (thousand 42-gallon barrels)	Uranium, U_3O_8 content (metric tons)
Mauritius	--	--	--	--	--	--	--	--
Morocco and Western Sahara	72,600	11,000 e	--	--	28,000	(3)	240	--
Mozambique	--	720	--	--	--	10	--	--
Namibia	55,455 e	--	2,356	--	--	--	--	3,617
Niger	--	54 e	--	--	--	176	--	4,049
Nigeria	--	3,000 e	--	--	--	10 e	813,950	--
Reunion	--	400 e	--	--	--	--	--	--
Rwanda	--	100 e	--	--	--	--	--	--
Sao Tome e Principe	--	--	--	--	--	--	--	--
Senegal	--	2,884	--	--	584	--	388	--
Seychelles	--	--	--	--	--	--	--	--
Sierra Leone	--	234	582	--	--	--	--	--
Somalia	--	--	--	--	--	--	--	--
South Africa	34,444 p	13,000 e	15,153	--	2,629 p	244,782 p	4,441 p	639 p
Sudan	--	202	--	--	--	--	158,000 e	--
Swaziland	--	--	--	--	--	311	--	--
Tanzania	--	1,422	272	--	3	18	--	--
Togo	--	800 e	28	--	1,650 e	--	--	--
Tunisia	--	6,932	--	--	7,801	--	25,000 p	--
Uganda	--	600 e	--	--	--	--	--	--
Zambia	--	650 e	--	--	--	100 e	--	--
Zimbabwe	--	700 e	1,046	6,588	66	2,107	--	--
Total	180,000	102,000	93,700	21,600	44,400	249,000	3,460,000	8,310
Share of world total	2%	4%	53%	2%	29%	5%	13%	19%
United States	727,000	99,700	--	--	30,100	977,000	3,610,000	1,970
Share of world total	7%	4%	--	--	20%	19%	14%	4%
World total	10,100,000	2,520,000	175,000	1,000,000	151,000	5,040,000	2,640,000	44,400

eEstimated; estimated data, U.S. data, and world totals are rounded to no more than three significant digits. pPreliminary. NA Not available. -- Zero or zero percent.

[1]Totals may not add owing to independent rounding. Percentages are calculated on unrounded data. Table includes data available as of June 10, 2008.

[2]Primary and secondary production.

[3]Less than 1/2 unit.

[4]Gemstones and industrial diamond.

[5]Does not include smuggled production.

[6]Production was approximately 90% gem and 10% industrial grade.

[7]Assumed to contain about 70% gem and near gem.

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TABLE 5
AFRICA: HISTORIC AND PROJECTED BAUXITE PRODUCTION, 1995-2013[1]

(Thousand metric tons)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Ghana	513	504	607	842	850	850	850
Guinea	15,800	15,700	14,600	14,800	20,000	20,000	25,600
Mozambique	11	8	10	12	12	12	12
Sierra Leone	--	--	--	1,072	1,200	1,200	4,200
Total	16,300	16,200	15,200	16,700	22,100	22,100	30,700

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

TABLE 6
AFRICA: HISTORIC AND PROJECTED ALUMINUM PRODUCTION, 1995-2013[1]

(Thousand metric tons)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Cameroon	79	86	87	87	90	260	250
Egypt	180	189	244	252	250	250	250
Ghana	135	137	13	36	100	100	100
Kenya[2]	2	2	2	2	2	2	2
Mozambique	--	54	555	564	560	560	560
Nigeria	--	--	--	--	100	193	193
South Africa	229	673	846	895	900	900	900
Total	630	1,100	1,700	1,800	2,000	2,300	2,300

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

[2]Kenya produced secondary refined aluminum; primary production in all other African countries.

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TABLE 7

AFRICA: HISTORIC AND PROJECTED COPPER MINE PRODUCTION, 1995-2013[1]

(Metal content in thousand metric tons)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Botswana	25	35	31	24	60	90	90
Congo (Kinshasa)	29	31	97	130	610	950	940
Eritrea	--	--	--	--	--	70	70
Mauritania	--	--	--	5	39	46	46
Morocco	14	7	3	3	3	3	3
Namibia	23	6	10	6	25	27	30
South Africa	166	137	97	100	126	135	138
Tanzania[2]	--	--	3	3	6	8	8
Zambia	316	249	447	514	800	900	1,000
Zimbabwe	9	2	3	3	2	2	2
Total	600	500	700	800	1,700	2,200	2,300

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

[2]Copper contained in concentrates and doré.

TABLE 8

AFRICA: HISTORIC AND PROJECTED REFINED COPPER PRODUCTION, 1995-2013[1]

(Thousand metric tons)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Botswana	--	--	(2)	--	5	20	20
Congo (Kinshasa)	35	--	--	--	190	510	510
Egypt[3]	4	4	14	14	14	14	14
South Africa	124	126	99	104	116	116	118
Zambia	328	227	399	460	600	700	700
Zimbabwe	7	10	2	2	2	2	2
Total	500	370	510	580	930	1,360	1,360

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

[2]Pilot plant production only.

[3]Egypt produced secondary refined copper; primary production in all other African countries.

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TABLE 9

AFRICA: HISTORIC AND PROJECTED GOLD MINE PRODUCTION, 1995-2013[1]

(Metal content in kilograms)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Algeria	--	--	697	377	1,500	1,500	1,000
Benin[2]	300	--	20	20	20	20	20
Botswana	86	4	2,709	3,020	3,200	3,200	3,200
Burkina Faso	1,319	625	1,397	1,571	9,800	9,800	9,800
Burundi	2,000	--	3,905	4,313	4,300	4,300	4,300
Cameroon[2]	800	1,000	18,895	20,000	15,000	15,000	15,000
Central African Republic	97	15	10	10	10	10	10
Chad	--	120	150	150	50	50	50
Congo (Brazzaville)	10	10	120	100	100	100	100
Congo (Kinshasa)	1,180	69	9,000	10,000	10,000	10,000	10,000
Côte d'Ivoire	1,983	3,444	1,335	1,324	5,000	6,600	6,600
Equatorial Guinea	50	500	200	200	200	200	200
Eritrea	59	264	25	25	13,200	840	1000
Ethiopia	4,500	3,206	4,376	4,028	4,000	4,000	4,000
Gabon	70	70	300	300	300	300	300
Ghana	53,087	72,080	66,852	66,205	70,000	70,000	70,000
Guinea	7,863	15,788	25,097	18,147	19,000	19,000	19,000
Kenya	170	1,243	616	432	650	650	650
Liberia	800	25	27	11	10	10	10
Madagascar	38	5	5	5	5	5	5
Mali	3,996	28,717	44,230[3]	51,957	58,200	58,200	58,200
Mauritania	1,196	--	--	322	5,300	5,300	5,300
Morocco	580	505	1,786	1,800	2,700	2,700	2,600
Mozambique	6,800	23	63	68	70	2,700	2,700
Namibia	2,394	2,417	2,703	2,790	2,800	2,500	2,500
Niger	1000	25	4,962	2,615	3,000	3,000	3,000
Nigeria	5	52	30	40	30	30	30
Rwanda	26	10	--	--	--	--	--
Senegal	--	550	600	600	600	600	600
Sierra Leone	4	--	53	71	70	70	70
South Africa	523,809	430,800	294,671	272,128	330,000	360,000	360,000
Sudan	3,700	5,774	3,625	3,158	2,700	--	--
Tanzania	320	15,060	52,236	47,000	50,000	56,000	56,000
Uganda	1,506	56	46	50	50	50	50
Zambia	91	600	440	800	1,000	1,100	1,200
Zimbabwe	23,959	22,069	14,024	11,354	8,000	15,000	20,000
Total	644,000	605,000	555,000	525,000	621,000	653,000	657,000

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

[2]From artisanal mining.

[3]Excludes artisanal mining, which was estimated to be 2,000 kilograms in 2005.

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TABLE 10

AFRICA: HISTORIC AND PROJECTED IRON ORE MINE PRODUCTION, 1995-2013[1]

(Fe content in thousand metric tons)

Country	Average grade[2]	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Algeria	50%	1,100	820	800	1,200	500	1,000	1,000
Egypt	55%	1,120	1,900	1,599	1,600	1,600	1,200	1,200
Liberia	57% to 64%	--	--	--	--	--	--	--
Mauritania	59% to 72%	7,000	7,500	7,000	7,250	7,300	7,300	7,300
Morocco	54%	32	4	4	4	4	4	4
Nigeria	36%	62	9	20	50	50	100	1,000
Senegal	42% to 59%	--	--	--	--	--	6,300	6,300
South Africa	62% to 65%	19,800	21,570	24,900	26,000	34,200	39,700	45,800
Tanzania	32%	14	--	--	--	--	--	--
Tunisia	54%	122	98	108	112	70	50	--
Uganda	61% to 67%	--	3	--	--	--	--	--
Zimbabwe[3]		160	225	185	52	100	100	200
Total		29,400	32,100	34,600	36,300	43,800	55,800	62,800

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more that three significant digits.

[2]Direct-shipping ore and concentrate.

[3]Average iron content for Zimbabwe prior to 1996 was 61%. Since 1996, the average grade has been 51%.

TABLE 11

AFRICA: HISTORIC AND PROJECTED STEEL PRODUCTION, 1995-2013[1]

(Thousand metric tons)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Algeria	827	842	1,007	1,200	1,700	2,500	2,500
Congo (Kinshasa)	NA	159	110	104	100	100	100
Egypt	2,642	2,838	5,600	5,500	5,500	5,500	5,500
Kenya	20	--	--	--	--	--	--
Libya	909	1,055	1,260	1,158	1,300	1,700	1,700
Mauritania	NA	5	1	1	1	1	1
Morocco	7	5	5	5	5	5	5
Nigeria	36	--	100	900	1,000	1,000	2,400
South Africa	8,741	8,481	9,493	9,721	11,600	12,000	12,000
Tunisia	201	237	66	68	200	200	200
Uganda	12	7	7	5	7	7	7
Zimbabwe	210	258	107	60	150	300	400
Total	13,600	13,900	17,600	17,700	20,400	22,100	22,200

[e]Estimated. NA Not available. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

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TABLE 12

AFRICA: HISTORIC AND PROJECTED LEAD MINE PRODUCTION, 1995-2013[1]

(Metal content in metric tons)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Algeria	1,383	818	--	--	--	--	--
Morocco	67,708	81,208	42,200	45,000	45,000	42,000	40,000
Namibia	16,084	11,114	14,320	11,830	15,300	15,300	7,000
Nigeria	NA	165	--	100	100	100	100
South Africa	88,449	75,262	42,159	48,273	48,000	48,000	48,000
Tunisia	6,601	6,602	8,708	--	--	--	--
Total	180,000	175,000	107,000	105,000	108,000	105,000	95,000

[e]Estimated. NA Not available. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

TABLE 13

AFRICA: HISTORIC AND PROJECTED PRIMARY AND SECONDARY REFINED LEAD PRODUCTION, 1995-2013[1]

(Metric tons)

Country[2]	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Algeria	8,300	6,100	5,000	5,000	--	--	--
Kenya	2,000	1,000	1,000	1,000	1,000	1,000	1,000
Morocco	59,673	66,812	39,000	47,700	50,000	40,000	40,000
Namibia	26,752	--	--	--	--	--	--
Nigeria	4,000	5,000	5,000	5,000	5,000	5,000	5,000
South Africa	32,100	46,200	65,300	70,000	67,000	67,000	67,000
Total	133,000	125,000	115,000	129,000	123,000	113,000	113,000

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

[2]Nigeria also refines a small quantity of primary lead.

TABLE 14

AFRICA: HISTORIC AND PROJECTED NICKEL MINE PRODUCTION, 1995-2013[1]

(Metal content in metric tons)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Botswana	18,088	38,420	39,305	38,000	38,000	25,000	25,000
Cameroon	--	--	--	--	--	3,200	3,200
Madagascar	--	--	--	--	--	60,000	60,000
Morocco	NA	84	99	80	100	100	100
South Africa	30,700	36,616	42,392	41,599	45,000	62,000	74,000
Zambia	--	--	--	--	10,000	10,500	10,500
Zimbabwe	11,721	8,160	8,556	8,825	9,000	8,000	7,500
Total	60,500	83,300	90,000	89,000	102,000	169,000	180,000

[e]Estimated. NA Not available. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

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TABLE 15

AFRICA: HISTORIC AND PROJECTED PLATINUM MINE PRODUCTION, 1995-2013[1]

(Metal content in kilograms)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Ethiopia	--	--	--	5	12	12	12
South Africa	102,300	114,459	163,711	168,125	198,000	217,000	241,000
Zimbabwe	7	505	4,834	4,998	8,000	11,000	11,000
Total	102,000	115,000	169,000	173,000	206,000	228,000	252,000

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

TABLE 16

AFRICA: HISTORIC AND PROJECTED PALLADIUM MINE PRODUCTION, 1995-2013[1]

(Metal content in kilograms)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
South Africa	51,000	55,818	82,961	86,265	111,000	120,000	132,000
Zimbabwe	17	366	3,879	4,022	6,500	9,000	9,000
Total	51,000	56,000	87,000	90,000	118,000	129,000	141,000

[e]Estimated.

[1]Estimated data and totals are rounded to no more than three significant digits.

TABLE 17

AFRICA: HISTORIC AND PROJECTED ZINC MINE PRODUCTION, 1995-2013[1]

(Metal content in metric tons)

Country[2]	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Algeria	7,174	10,452	4,463	572	--	1,000	3,000
Burkina Faso	--	--	--	--	68,000	68,000	68,000
Congo (Kinshasha)	4,500	--	7,500	16,500	16,000	16,000	16,000
Morocco	79,947	103,064	78,660	72,600	70,000	70,000	70,000
Namibia[3]	30,209	39,126	69,368	55,455	65,000	65,000	30,000
South Africa	70,241	63,590	32,112	34,444	34,000	34,000	34,000
Tunisia	44,244	41,247	15,889	--	--	--	--
Total	236,000	257,000	208,000	180,000	253,000	254,000	221,000

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

[2]Nigeria also mined a small quantity of zinc.

[3]Does not include zinc content of ore processed at Skorpion solvent extraction-electrowinning facility.

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TABLE 18

AFRICA: HISTORIC AND PROJECTED ZINC METAL PRODUCTION, 1995-2013[1]

(Metal content in metric tons)

Country[2]	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Algeria	30,000	34,000	30,000	30,000	30,000	30,000	30,000
Namibia	--	--	132,818	129,897	150,000	150,000	150,000
South Africa	98,782	103,000	102,000	90,000	120,000	120,000	120,000
Total	129,000	137,000	265,000	250,000	300,000	300,000	300,000

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

[2]Nigeria also refined a small quantity of zinc.

TABLE 19

AFRICA: HISTORIC AND PROJECTED DIAMOND MINE PRODUCTION, 1995-2013[1]

(Thousand carats)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Angola[2, 3]	2,900	4,313	7,079	9,175	10,000	10,000	10,000
Botswana	16,802	24,635	31,890	34,293	35,000	35,000	35,000
Cameroon	NA	NA	12	12	12	12	12
Central African Republic	530	464	383	420	400	400	400
Congo (Brazzaville)	NA	50	50	50	50	50	50
Congo (Kinshasa)	22,024	16,006	35,207	28,540	27,200	27,200	27,200
Côte d'Ivoire	75	320	300	300	300	300	300
Gabon	1	1	(4)	(4)	(4)	(4)	(4)
Ghana	632	878	1,013	973	1,000	1,000	1,000
Guinea	365	327	549	474	1,000	1,000	1,000
Lesotho	NA	2	37	37	390	390	390
Liberia	150	170	NA	NA	20	20	20
Namibia	1,382	1,552	1,902	2,356	4,000	9,000	8,000
Sierra Leone	214	77	669	582	600	600	600
South Africa	9,683	10,790	15,776	15,153	16,100	16,700	16,700
Tanzania	50	354	220	272	580	580	580
Togo	NA	NA	41	28	30	30	30
Zimbabwe	204	23	251	1,046	1,000	700	700
Total	55,000	60,000	95,400	93,700	97,700	103,000	102,000

[e]Estimated. NA Not available.

[1]Estimated data and totals are rounded to no more than three significant digits.

[2]Does not include smuggled production.

[3]Production was about 90% gem and 10% industrial grade.

[4]Less than 1 unit.

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TABLE 20

AFRICA: HISTORIC AND PROJECTED PHOSPHATE ROCK PRODUCTION, 1995-2013[1]

(P_2O_5 content in thousand metric tons)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Algeria	500	265	260	460	350	300	250
Burkina Faso	NA	NA	1	1	1	1	1
Egypt	207	317	622	625	800	800	800
Mali	1	--	--	--	--	--	--
Morocco	6,399	7,200	9,195	9,100	9,500	9,500	9,500
Senegal	556	626	464	187	200	200	200
South Africa	1,101	1,083	1,000	1,000	1,000	1,000	1,000
Tanzania	2	2	2	1	1	1	1
Togo	930	490	481	590	600	600	600
Tunisia	2,181	2,500	2,500	2,400	2,400	2,300	2,300
Zimbabwe	45	25	14	20	15	25	25
Total	11,900	12,500	14,500	14,400	14,900	14,700	14,700

[e]Estimated. NA Not available. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

TABLE 21

AFRICA: HISTORIC AND PROJECTED SALABLE COAL PRODUCTION, 1995-2013[1]

(Thousand metric tons)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Botswana	898	947	985	962	1,200	5,200	5,000
Congo (Kinshasa)	10	--	1	1	1	1	1
Egypt	10	39	75	75	75	75	75
Malawi	15	34	45	48	48	48	48
Morocco	650	31	(2)	(2)	(2)	(2)	(2)
Mozambique	40	16	3	10	260	12,800	12,800
Niger	135	158	182	176	180	180	180
Nigeria	29	12	--	10	50	50	50
South Africa	206,210	224,118	244,940	244,782	264,000	286,000	295,000
Swaziland	172	178	222	311	300	300	300
Tanzania	43	79	75	18	150	150	150
Zambia	141	168	240	100	100	120	150
Zimbabwe	5,538	3,809	2,891	2,107	2,500	4,000	4,000
Total	214,000	230,000	250,000	249,000	269,000	309,000	318,000

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

[2]Less than 1 unit.

TABLE 22

AFRICA: HISTORIC AND PROJECTED URANIUM PRODUCTION, 1995-2013[1]

(U content in metric tons)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Gabon	770	--	--	--	--	--	--
Malawi	--	--	--	--	1,300	1,300	1,300
Namibia	2,006	2,714	3,147	3,067	5,000	7,000	8,000
Niger	2,970	2,895	3,093	3,434	3,400	3,400	3,400
South Africa	1,443	861	674	542	1,800	2,800	2,900
Total	7,200	6,500	6,900	7,000	11,500	14,500	15,600

[e]Estimated. -- Negligible or no production.

[1]Estimated data and totals are rounded to no more than three significant digits.

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THE MINERAL INDUSTRY OF ALGERIA

By Philip M. Mobbs

Hydrocarbons remained the leading sector in Algeria's mineral industry, which included diverse but modest production of metals and industrial minerals. In 2006, helium production in Algeria accounted for about 13% of total world output. Hydrocarbons produced in Algeria accounted for about 2.9% of total world natural gas output and about 2.2% of total world crude oil output. Algeria held about 21% of total world identified resources of helium, 2.5% of total world natural gas reserves, and about 1% of total world crude oil reserves (BP p.l.c. 2007, p. 6, 8, 22, 24; Pacheco, 2007).

The mineral industry was managed primarily by the Ministère de l'Énergie et des Mines (Ministry of Energy and Mines) and subsidiary organizations, such as the Agence Nationale du Patrimoine Minier (ANPM) (National Agency for Mining Endowment). Processed mineral commodities, such as cement, fertilizers, and steel, were under the jurisdiction of the Ministère de l'Industrie et de la Restructuration (Ministry of Industry and Restructuring).

Nonfuel mineral operations were regulated by law No. 01-10 of July 3, 2001, and associated decrees. Natural gas and petroleum operations were regulated by law No. 05-07 of April 28, 2005. Environmental laws applicable to the mineral industry included law No. 03-10 of July 19, 2003, and associated decrees, and law No. 05-12 of September 4, 2005.

Minerals in the National Economy

Revenue attributed to natural gas and petroleum production, processing, and sales activity accounted for 78% of Government income. Hydrocarbon activity accounted for more than 33% of the nation's gross domestic product (GDP). The continued increase of international crude oil and natural gas prices resulted in a significant increase in the value of Algerian exports, most of which were shipped through the country's eight main seaports or exported by pipeline. In 2006, Algerian exports of goods and services were valued at $57.3 billion,[1] of which hydrocarbons accounted for about $53.6 billion, compared with 2005, when exports of goods and services were valued at $48.8 billion, of which hydrocarbons accounted for about $45.6 billion. Other mineral commodity exports included base metals (about $206 million), iron and steel ($197 million), industrial minerals (about $52 million), and precious minerals (about $4 million) (Banque d'Algérie, 2007; Ministère de l'Énergie et des Mines, 2007, p. 9).

About 28,000 people were employed in the mining sector, of which slightly less than one-half was in the private sector. Aggregate and stone production companies accounted for more than 60% of the mining sector workforce; clay production companies, 12%; phosphate production companies, 6%; and iron ore production companies, 5%.

[1]Where necessary, currency values have been converted from Algerian dinars (DA) to U.S. dollars (US$) at the average rate of DA75.18=US$1.00 for 2006 and DA73.44=US$1.00 for 2005.

Production

Several significant changes in production were posted in 2006. Mineral commodities with notable production increases included aggregate and crushed stone, barite, cement, dolomite, feldspar, iron ore, phosphate rock, salt, construction sand, and steel. Mineral commodities with notable production decreases included ammonia, gold, gypsum, helium, pozzolan, quartzite, silica sand, silver, and zinc.

Structure of the Mineral Industry

About 950 nonfuel mineral operations were active in Algeria in 2006, of which nearly 70% were aggregates, construction sand, or crushed stone operations. Private-sector companies dominated the aggregate, common clay, gypsum, and sand sectors. Large- and medium-sized public-sector enterprises dominated the ranks of barite, bentonite, cement, natural gas, petroleum, and phosphate rock producers. The joint ventures of private and state-owned companies dominated the gold production sector [Entreprise d'Exploitation des Mines d'Or s.p.a. (ENOR)], the helium production sector (Helios s.p.a.), and the steel production sector (Mittal Steel Annaba s.p.a.).

In late 2006, the Government offered to sell its majority interests in Société des Mines de Baryte d'Algérie s.p.a., Société des Diatomites d'Algérie s.p.a., and Société des Feldspaths d'Algérie s.p.a. [all of which were subsidiaries of state-owned Entreprise Nationale des Produits Miniers Non Ferreux et des Substances Utiles, s.p.a. (ENOF)]. In 2006, ENOF closed the Chabet El Hamra zinc mine, and Société des Kaolins d'Algérie s.p.a. (which was an ENOF subsidiary) closed the Djebel Debbagh kaolin pit.

Commodity Review

In 2006, about 300 exploration permits were in effect. Notable exploration and development and redevelopment contracts under negotiation included those with subsidiaries of the Mineral Resources Management Bureau of Henan Province, China, for the Boukais copper prospect, the Boukhedma-Aïn Sedjra-Kef Semmah lead zinc prospects, the El Abed zinc prospect, the Guettara manganese prospect, and the Issefane gold prospect. Western Mediterranean Zinc s.p.a., which was a joint venture of Terramin Australia Ltd. (65% interest) and ENOF (35% interest), acquired the rights to explore the Oued Amizour zinc project.

Metals

Gold.—ENOR produced 38,914 metric tons (t) of ore with an average grade of 9.57 grams per metric ton gold from the Tirek Mine in 2006, which was significantly less than the 65,718 t of ore that the company mined in 2005. The decline was attributed

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to the delayed delivery of equipment. Development of the Amesmessa Mine continued; production was expected to begin in 2007 (GMA Resources Plc, 2007, p. 6-7).

Lead, Silver, and Zinc.—Assays of samples from a 5-hole drilling program at the Tan Chaffao deposit by Tan Chaffao Mining Co. S.A.R.L., which was a joint venture of Maghreb Minerals PLC of the United Kingdom (85% interest) and Gold and Industrial Minerals [GOLDIM] [which was a subsidiary of the Government-owned Office National de la Recherche Géologique et Minière (15%)] indicated less than expected mineralization. At yearend, the joint venture was reevaluating whether to continue exploration of the isolated Tan Chaffao deposit, which is located about 250 kilometers (km) northwest of Tamanrasset (Hanson Westhouse LLP, 2006, p. 8-9).

In late 2006, Western Mediterranean Zinc began a drilling program on the Tala Hamza deposit of the Oued Amizour zinc project. Tala Hamza was located about 12 km southwest of the Port of Bejaia.

Mineral Fuels and Related Materials

Helium and Liquefied Natural Gas.—In 2006, the testing of the Helison Production s.p.a. plant located at the GL1K liquefied natural gas (LNG) facility in Skikda resulted in the plant's initial liquid helium production. Designed with a nominal production capacity of 16 million cubic meters per year of liquid helium, the plant capacity would be restricted to 8 million cubic meters per year because of an explosion and fire that destroyed three LNG trains at Skikda in 2004. The construction of a 4.5-million-metric-ton-per-year-capacity LNG train at the GL1K facility (to replace the destroyed LNG trains) was expected to begin in 2007 (KBR, 2007; Helison Marketing Ltd., undated).

Petroleum and Natural Gas.—High international crude oil and natural gas prices encouraged stepped-up exploration and development drilling in Algeria. The number of exploration wells drilled in 2006 increased to 77 compared with 64 in 2005 and 36 in 2001. The number of development wells drilled in 2006 increased to 208 compared with 161 in 2005 and 175 in 2001.

Outlook

Owing to its hydrocarbon resources and associated infrastructure and its location close to Europe (which was the major market for its minerals), Algeria's hydrocarbon sector is expected to continue to attract foreign direct investment. Continued high international commodity prices were expected to encourage continued domestic and international interest in the Government's program to partially divest its ownership interest in nonfuel mineral operations.

Successful mineral fuel and nonfuel mineral exploration could result in increased mineral commodity development opportunities. The Government proposes to increase oil production (subject to production quotas of the Organization of the Petroleum Exporting Countries) and to increase natural gas exports by 2010.

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TABLE 1
ALGERIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2, 3]		2002	2003	2004	2005	2006[p]
METALS						
Cadmium, refined[e]		8	5	--	--	--
Gold	kilograms	369	365	597	697	377
Iron and steel:						
Iron ore, gross weight	thousand metric tons	1,202	1,378	1,554	1,579	2,340
Metal:						
Pig iron	do.	960 [e]	965	994	952	1,000 [e]
Steel, crude	do.	1,091	1,051	1,014	1,007	1,200
Lead:						
Concentrate, Pb content		1,105	--	--	--	--
Metal, refined[e]		6,000	6,100	5,000	5,000	5,000
Mercury	kilograms	307,119	175,600	73,451	276	--
Silver[e]	do.	1,400	500	40	800	100
Zinc:						
Concentrate, Zn content		8,576	2,796	231	4,463	572
Metal, smelter output[e]		26,136 [4]	32,200	25,000	30,000	30,000
INDUSTRIAL MINERALS						
Barite, crude		51,773	45,649	47,945	52,813	64,787
Cement, hydraulic[e]	thousand metric tons	9,000	9,000	11,000 [r]	11,296 [r, 4]	15,000
Clays:						
Bentonite		27,178	25,346	30,319	29,029	27,110
Common	thousand cubic meters	1,660	1,840	2,490	7,383	7,307
Fuller's earth		3,521	2,573	2,284	831	--
Kaolin		9,505	16,591	24,299	34,386	32,523
Diatomite		3,185	2,595	2,665	1,814	1,800
Feldspar		NA	NA	NA	43,872	65,615
Gypsum[5]	thousand metric tons	322	350	1,058	1,460	1,033
Lime, hydraulic[e]		100,000	100,000	163,000 [4]	163,000	170,000
Nitrogen, N content of ammonia[6]		563,100	578,200	542,800	550,000 [e]	470,000 [e]
Phosphate rock:						
Gross weight	thousand metric tons	740	905	1,017	878	1,510
P_2O_5 content[e]	do.	230	280	300	260	460
Pozzolan		451,000	500,000	508,000	494,000	433,190
Salt, brine and sea salt		205,321	191,017	183,000	191,132 [r]	259,596
Sand and gravel:						
Aggregate, crushed stone, and gravel	thousand cubic meters	11,691	13,769	17,022	21,768	25,251
Construction sand	do.	392	495	585	1,599 [r]	2,143
Silica sand	cubic meters	NA	NA	NA	202,770	85,862
Stone:						
Aragonite	cubic meters	NA	NA	NA	1,400	--
Dolomite		NA	NA	NA	4,484	7,506
Quartzite		NA	NA	NA	12,770	5,860
Marble:						
Blocks	thousand cubic meters	23	24	22	14 [r]	16
Crushed		108,682	105,249	120,666	153,770	147,674
Slabs	thousand square meters	215	180	99	87	90 [e]
Miscellaneous types of dressed stone	do.	2,032	1,945	2,000 [e]	4,622	3,701
Rhyolite	cubic meters	NA	NA	NA	2,960	3,200
Tuff	thousand cubic meters	522	685	791	991	951
Sulfur, S content of sulfuric acid[e]		19,300	20,000	21,000	22,000	22,000
MINERAL FUELS AND RELATED MATERIALS						
Coke	thousand metric tons	450 [e]	450 [e]	439 [r]	398 [r]	450
Gas, natural:						
Gross	million cubic meters	139,998	137,634	144,281	151,775	149,509
Dry[7]	do.	101,557	98,754	98,111	98,784	98,000 [e]
Helium, liquid[e]	do.	17	17	17	17	15
Methanol		91,470	115,690	107,360	94,200	103,250
Natural gas plant liquids	thousand 42-gallon barrels	100,850	98,100	99,380	99,780	89,000

See footnotes at end of table.

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TABLE 1--Continued
ALGERIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2,3]		2002	2003	2004	2005	2006[p]
MINERAL FUELS AND RELATED MATERIALS--Continued						
Petroleum:						
Crude, including condensate	thousand 42-gallon barrels	499,890	562,201 [r]	597,270 [r]	618,673 [r]	619,294
Refinery products:						
Liquefied petroleum gas	do.	6,870	7,050	6,620	5,780	5,740
Gasoline	do.	16,540	16,150	15,990	17,560	19,800
Naphtha	do.	33,690	34,230	25,220	26,440	24,600
Kerosene and jet fuel	do.	10,770	10,170	7,810	8,480	7,570
Distillate fuel oil	do.	45,100	46,150	42,820	44,360	47,500
Lubricants	do.	875	980	1,090	1,120	1,030
Residual fuel oil	do.	38,850	41,150	37,030	33,670	35,600
Other	do.	2,690	2,120	1,860	1,920	3,000 [e]
Total	do.	155,385	158,000	138,440	139,330	145,000 [e]

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [p]Preliminary. [r]Revised. NA Not available. -- Zero.

[1]Table includes data available through November 13, 2007.

[2]In addition to the commodities listed, secondary aluminum, secondary copper, and secondary lead may be produced in small quantities; crude construction materials for local consumption, and fertilizer, perlite, and urea are produced, but available information is inadequate to make estimates of production.

[3]In addition to the commodities listed, about 700 metric tons per year (t/yr) of caustic soda is estimated to have been produced.

[4]Reported figure.

[5]Includes about 50,000 t/yr of plaster.

[6]Additional nitrogen was produced by Helios s.p.a., which is a helium liquids production company.

[7]Excludes gas used in flaring, reinjection, transmission losses, and venting.

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TABLE 2
ALGERIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Ammonia	Le groupe ASMIDAL	Alzofert plant at Arzew	660,000
Do.	do.	Fertial plant at Annaba	330,000
Barite	Société des Mines de Baryte d'Algérie s.p.a. (Entreprise Nationale des Produits Miniers Non Ferreux et des Substances Utiles, s.p.a.)	Draissa Mine and plant	100,000
Do.	do.	Ain Mimoun	40,000
Do.	do.	Boucaid	40,000
Bentonite	Société des Bentonites d'Algérie s.p.a. (Entreprise Nationale des Produits Miniers Non Ferreux et des Substances Utiles, s.p.a.)	Roussel quarry, near Maghnia	30,000
Do.	do.	Bentonite treatment plant in Maghnia	13,000
Cement:			
Portland	Algerian Cement Co. (Orascom Construction Industries S.A., 100%)	M'Sila	5,000,000
Do.	Ciment Blanc d'Algerie (Orascom Construction Industries S.A., 100%)	60 kilometers east of Oran	2,500,000 [1]
Do.	Entreprise des Ciments et Dérivés d'Ech—Cheliff	Chlef	2,000,000
Do.	Société des Ciments de la Mitidja (Entreprise des Ciments et Dérivés du Centre)	Meftah	1,000,000
Do.	Société des Ciments de Sour El Ghozlane (Entreprise des Ciments et Dérivés du Centre)	Sour El Ghozlane	1,000,000
Do.	Société des Ciments Zahana (Entreprise des Ciments et Dérivés de l'Ouest)	Zahana	1,200,000
Do.	Société des Ciments Beni Saf (Entreprise des Ciments et Dérivés de l'Ouest)	Beni Saf	1,000,000
Do.	Société des Ciments Saïda (Entreprise des Ciments et Dérivés de l'Ouest)	Hassasna	500,000
Do.	Société des Ciments d'Aïn-Touta (Entreprise des Ciments et Dérivés de l'Est)	Ain Touta	1,000,000
Do.	Société des Ciments d'Aïn-Kébira (Entreprise des Ciments et Dérivés de l'Est)	Ain-Kebira	1,000,000
Do.	Société des Ciments de Hamma-Bouziane (Entreprise des Ciments et Dérivés de l'Est)	Hamma-Bouziane	1,000,000
Do.	Société des Ciments de Hadjar Soud (Entreprise des Ciments et Dérivés de l'Est)	Bekkouche	900,000
Do.	Société des Ciments de Tébessa (Entreprise des Ciments et Dérivés de l'Est)	Tebessa	525,000
Do.	Société des Ciments de l'Algérois (Entreprise des Ciments et Dérivés du Centre)	Rais-Hamidou	368,000
White	Ciment Blanc d'Algerie (Orascom Construction Industries S.A., 100%)	60 kilometers east of Oran	550,000 [1]
Coke	Mittal Steel Annaba s.p.a. (Mittal Steel Co. N.V. of the Netherlands, 70%; and Groupe Industriel Sider, 30%))	El Hadjar	1,200,000
Copper, cathode	Société Algérienne du Zinc (Entreprise Nationale de Métallurgie et de Transformation des Métaux Non Ferreux, s.p.a., 100%)	Ghazaouet	NA
Diatomite	Société des Diatomites d'Algérie s.p.a. (Entreprise Nationale des Produits Miniers Non Ferreux et des Substances Utiles, s.p.a.)	Tahalait Quarry at Sig	80,000
Feldspar	Société des Feldspaths d'Algérie s.p.a. (Entreprise Nationale des Produits Miniers Non Ferreux et des Substances Utiles, s.p.a., 57%, and Entreprise de la Ceramique Ouest, 43%)	Mine at Ain Barbar	65,000
Fertilizers:			
Nitrogenous:			
Ammonium nitrate	Le groupe ASMIDAL	Alzofert plant at Arzew	495,000
Do.	do.	Fertial plant at Annaba	330,000
Do.	do.	do.	240,000
Do.	Fertalge Industries s.p.a.	Arzew	360,000
Phosphatic[2]	do.	Fertial plant at Annaba	800,000
Gold, gold content of mine output kilograms	Entreprise d'Exploitation des Mines d'Or s.p.a. [Gold Mines of Algeria Pty. Ltd., 52%; Société Nationale pour la Recherche, la Production, le Transport, la Transformation et la Commercialisation des Hydrocarbures, s.p.a. (Sonatrach), 16.38%; Banque d'Algerie, 16.22%; Société Nationale d'Assurance, 8.43%; Entreprise Nationale des Produits Miniers Non Ferreux et des Substances Utiles, s.p.a., 4.8%]	Tirek Mine	3,000
Do. do.	do.	Amesmessa Mine	3,000 [1]
Gypsum	About 60 small- or medium-scale operations	Various locations	NA

See footnotes at end of table.

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TABLE 2--Continued
ALGERIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Helium	million cubic meters	Helios s.p.a. (Sonatrach Valorisation Hydrocarbons, 51%, and Helap S.A., 49%)	G12Z complex at Arzew	17
Do.	do.	Helison Production s.p.a. [Linde AG of Germany, 50%, and Société Nationale pour la Recherche, la Production, le Transport, la Transformation et la Commercialisation des Hydrocarbures, s.p.a. (Sonatrach), 50%]	GL1K complex at Skikda	8 [1]
Iron ore		Mittal Steel Tebessa s.p.a. (Mittal Steel Co. N.V. of the Netherlands, 70%, and Entreprise Nationale du Fer et du Phosphate, 30%)	Ouenza Mine	3,600,000
Do.		do.	Boukhrada Mine	1,000,000
Do.		Entreprise Nationale du Fer et du Phosphate	Mines at Anini and Rouina	100,000
Kaolin		Société des Kaolins d'Algérie s.p.a. (Entreprise Nationale des Produits Miniers Non Ferreux et des Substances Utiles, s.p.a.)	El Milia	35,000
Do.		do.	Djebel Debbagh	25,000 [3]
Lime		Société des Ciments Saïda (Entreprise des Ciments et Dérivés de l'Ouest)	Hassasna	100,000
Do.		Société de Chaux de l'Ouest	Oran	65,000
Do.		Unité Chaux de Chettaba (Société des Produits Dérivés de l'Est, 100%)	Chettaba	11,000
Marble		Entreprise Nationale d'Extraction, Transformation, Production et Commercialisation du Marbre et de Dérivés de Marbre s.p.a.	Quarries at Bensekrane, Filfila, Ghazaouet, and Oum El Assel	NA
Do.		do.	Processing plants at Guelma, Oran, Sig, and Skikda	NA
Mercury	kilograms	Entreprise Nationale des Produits Miniers Non Ferreux et des Substances Utiles, s.p.a.	Ismail and M'Rasma; mines near Azzaba	450,000 [3]
Methanol		ENIP s.p.a. (Holding Sonatrach Raffinage et Chimie des Hydrocarbures, 100%)	Methanol plant at Arzew	113,000
Natural gas:				
Crude	million cubic meters	Société Nationale pour la Recherche, la Production, le Transport, la Transformation et la Commercialisation des Hydrocarbures, s.p.a. (Sonatrach)	Numerous gasfields, including Adrar, Hamra, Hassi R'Mel, and Sbaa	122,000
Do.	do.	Other companies in association with Sonatrach	Numerous gasfields	28,000
Liquefied	do.	Société Nationale pour la Recherche, la Production, le Transport, la Transformation et la Commercialisation des Hydrocarbures, s.p.a. (Sonatrach)	GL2Z complex at Bethioua	18 [4]
Do.	do.	do.	GL1Z complex at Bethioua	18 [4]
Do.	do.	do.	GL1K complex at Skikda	7 [4]
Do.	do.	do.	GL4Z complex at Arzew	2 [4]
Petroleum:				
Crude	42-gallon barrels per day	do.	About 50 oilfields, including Acheb West, Amassak/Tin-Yaguene, Draa Tamra, Edjeleh, El Borma, El Gassi, Gassi-Touil East, Guellala, Hassi Messaoud North and South, Ohanet North, Rhourde El Baguel, Tin-Fouye, and Zarzaitine	780,000
Refined	do.	Société Nationale de Raffinage de Pétrole-NAFTEC s.p.a.	RA1K refinery at Skikda	300,000
Do.	do.	do.	RA1G refinery at Algiers	60,000
Do.	do.	do.	RA1Z refinery at Arzew	60,000
Do.	do.	do.	RHM refinery at Hassi-Messaoud	30,000
Phosphate rock		Entreprise de'Exploitation, Commercialisation et Exportation du Fer et du Phosphate s.p.a.	Djebel Onk, Kef Snoun	1,500,000
Pozzolana		Entreprise Nationale du Fer et du Phosphate	Beni Saf	600,000
Salt:				
Crude, rock		Entreprise Nationale d'Exploitation des Carrières de Sels Industriels et Domestiques et Commercialisation des Sels s.p.a.	El Outaya, Biskra	NA
Crude, solar		do.	Bethioua, Oran; El Meghaier, El Oued, Guergour Lamri, Setif Ouled Zouai, Oum el Bouaghi, and Sidi Bouziane, Relizane	300,000
Refined		do.	El Outaya refinery at Biskra	50,000

See footnotes at end of table.

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TABLE 2--Continued
ALGERIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Steel:			
Crude	Mittal Steel Annaba s.p.a. (Mittal Steel Co. N.V. of the Netherlands, 70%, and Groupe Industriel Sider, 30%)	Blast furnaces at El Hadjar, Annaba	2,100,000
Do.	do.	Electric arc furnace at El Hadjar, Annaba	400,000
Processed	do.	Hot strip mill at El Hadjar, Annaba	1,800,000
Do.	do.	Cold rolling mill at El Hadjar, Annaba	1,050,000
Do.	do.	Bar and wire rod mills at El Hadjar, Annaba	850,000
Do.	do.	Seamless tube mill at El Hadjar, Annaba	700,000
Do.	Entreprise Nationale de Tubes et de Transformation de Produits Plats (Groupe Industriel Sider, 100%)	Welded tube plant at Ghardaia	128,000
Do.	Société Algérienne de Fabrication Tubes en Spirale (Groupe Industriel Sider, 100%)	Welded tube plant at El Hadjar, Annaba	70,000
Stone	L'Algérienne des Granulats s.p.a. (Entreprise Nationale des Produits Miniers Non Ferreux et des Substances Utiles, s.p.a.)	Aggregate quarries at Adrad Oufarnou, Arzew, Ghedir, Gustar, Keddara, Oued Fodda, Teioueit, and Timezrit	3,000,000
Do.	Société des Diatomites d'Algérie s.p.a. (Entreprise Nationale des Produits Miniers Non Ferreux et des Substances Utiles, s.p.a.)	Oggaz limestone quarry, near Sig	12,500
Do.	Société des Bentonites d'Algérie s.p.a. (Entreprise Nationale des Produits Miniers Non Ferreux et des Substances Utiles, s.p.a.)	Limestone quarries, near Beni Saf and M'Said	12,000
Do.	Various other companies	About 680 other active quarries	NA
Sulfuric acid	Société Algérienne du Zinc (Entreprise Nationale de Métallurgie et de Transformation des Métaux Non Ferreux, 100%)	Ghazaouet	70,000
Urea	Fertalge Industries s.p.a.	Arzew	400,000
Zinc, ore			
Ore	Entreprise Nationale des Produits Miniers Non Ferreux et des Substances Utiles, s.p.a.	Chabet El Hamra, El Abed, and Kherzet Youcef Mines	NA [3]
Metal	Société Algérienne du Zinc (Entreprise Nationale de Métallurgie et de Transformation des Métaux Non Ferreux, 100%)	Ghazaouet	30,000

NA Not available.
[1]Under construction.
[2]Capacity includes 500,000 to 600,000 metric tons per year (t/yr) of compound fertilizer [nitrogen, phosphorus, and potassium (NPK), or phosphorus and potassium (PK)], or triple superphosphate (TSP), and 240,000 t/yr of single superphosphate (SSP).
[3]Closed.
[4]One cubic meter of liquefied natural gas is equivalent to 584 cubic meters of natural gas. Natural-gas-equivalent capacities (in billions of cubic meters) were GL2Z--10.3, GL1Z--10.2, GL1K--4, and GL3Z--1.1.

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The Mineral Industry of Angola

By Omayra Bermúdez-Lugo

Angola's mineral industry was dominated by diamond and petroleum production. Other mineral commodities produced in the country included cement, granite, marble, and, salt. Undeveloped mineral resources included copper, gold, gypsum, iron ore, lead, lignite, manganese, mica, nickel, peat, phosphate rock, silver, and zinc.

Minerals in the National Economy

Petroleum continued to be the major driving force of Angola's economy, accounting for about 51.7% of the gross domestic product, 96% of exports, and 80% of Government revenues. In 2006, Angola ranked seventh among the world's leading producers of rough diamond by volume and fifth in terms of value. The presence of a significant amount of landmines and other unexploded ordnance continued to hinder mining activities in the country. During Angola's 27-year war, Government and rebel forces and foreign armies laid landmines across the country's 18 Provinces. Although the exact number of landmines is unknown, estimates ranged from between 500,000 and 6 million (Kimberley Process Certification Scheme, 2006a, b; U.S. Department of State, 2006; Reuters, 2007).

Foreign direct investment in the oil and mining sectors of the country was growing fast. Angola was Africa's third ranked recipient of foreign direct investment following Morocco and Equatorial Guinea. The discovery of new oilfields, the increasing cost-effectiveness of deepwater exploration in the context of high oil prices, and the strategic interest of American businesses and of such nontraditional partners as China and India were, according to the World Bank, the driving forces behind the investment activity (World Bank Group, 2006, p. 82-84).

Angola was the second ranked trading partner of the United States in sub-Saharan Africa. U.S. exports to sub-Saharan Africa totaled $12.1 billion in 2006, or about 1.2% of U.S. total world exports of $1,036 billion. U.S. imports from sub-Saharan Africa totaled $59.1 billion for the same period, or about 3.2% of U.S. total imports from the world. In 2006, about 20% of all U.S. imports from the region came from Angola and about 13% of all U.S. exports to the region went to Angola. Angola's exports to the United States were valued at about $11.7 billion in 2006 compared with about $8.5 billion in 2005. Of this amount, crude petroleum accounted for about $11.3 billion; fuel oil, about $238 million; and gem-quality diamond, about $35.6 million. Imports from the United States were valued at about $1.5 billion in 2006 compared with a revised $929 million in 2005; these included nearly $480 million in drilling and oilfield equipment and about $8.9 million in excavating machinery (Langton, 2007, p. 6; U.S. Census Bureau, 2008a, b).

Production

In 2006, petroleum production increased by about 12.6% to reach nearly 514 million barrels compared with about 456 million barrels in 2005 (table 1); diamond production increased by 29.6% to reach 9,175 thousand carats compared with 7,079 thousand carats in 2005. Salt production increased by 16% and crude petroleum production increased by 12.6%. Data on mineral production are provided in table 1.

Structure of the Mineral Industry

The Ministério de Geologia e Minas is the Government entity responsible for the negotiation of mineral rights contracts, for enforcing mining laws, and for conducting geologic surveys. All mineral rights in Angola belong to the state, and all mining and prospecting contracts must be approved by the Council of Ministers. Corpo Especial de Fiscalização y Segurança de Diamantes is the Government agency responsible for overseeing the diamond sector. Empresa Nacional de Diamantes de Angola E.P. (Endiama), which is the Government-owned diamond company, is responsible for creating partnerships with international companies prospecting for diamond and is a partner in all diamond ventures. Endiama's subsidiaries include Sociedade de Comercialização de Diamantes de Angola (Sodiam), which is in charge of the marketing, sale, and trade of all diamond produced in Angola and the entity responsible for Kimberley Process compliance; and Endiama Prospeção e Produção S.A.R.L., which oversees all Endiama's mining and prospecting interests. Sociedade Nacional de Combustíveis de Angola (Sonangol) is the Government-owned company responsible for petroleum exploration and production.

Several infrastructure projects were underway in Angola during 2006. One of the projects was the modernization of the Luanda Port at a cost of $131 million through 2010. About $24 million was to be spent on the project during the first year of construction. Other projects included the refurbishing of the Benguela and the Mocamedes railways. In January, the tender for the rehabilitation of the Benguela railway was granted to China International Fund Limited. The company expected to complete the project by August 2007 at a cost of $330.5 million. Once completed, the railway would have the capacity to transport about 20 million metric tons per year (Mt/yr) of cargo. About 700 kilometers (km) of the railway line, which runs from the city of Lobito in Benguela Province to Bie Province in the central highlands, had to be cleared of landmines. Also under reconstruction was the Mocamedes railway, which runs from Namibe on the Atlantic coast in southwest Angola through Lubango and Matala in Huila Province and into Menongue (the capital of Kuando Kubango Province) in the southeastern part of the country. The refurbishment of the Mocamedes railway was also expected to be completed in August 2007 at a cost of $1.2 billion; it would have the capacity to transport about 15 Mt/yr of cargo (Republic of Angola Embassy in the United Kingdom, 2006b, c).

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Metals

Bauxite and Alumina and Aluminum.—Norsk Hydro ASA of Norway was studying the possibility of developing a 600,000-metric-ton-per-year (t/yr) primary aluminum smelter in Angola and a 1,635-megawatt hydroelectric facility to supply electricity to the plant (Mining Journal, 2006b; World Aluminium Market, 2006).

Copper.—Simba Mines Inc. of the United States held the rights to carry out prospecting, survey, and reconnaissance operations on the Benguela (35%), the Cachoeiras de Binga (CDB) (40%), and the Zenza (35%) copper properties in Angola. Measured resources at CDB were reported to be 7.1 Mt of copper ore at a grade of 2.14% copper. The company planned to develop a mine at CDB and to produce about 20,000 t/yr of copper initially and to eventually increase capacity to 50,000 t/yr. In April 2006, Simba announced that it had completed phase 1 of its exploration program for CDB, which consisted of mapping, soil geochemistry, and limited geophysics with the purpose of further extending known resources and conducting a bankable feasibility study. In September, the company entered into a definitive agreement to exchange its mining interest in CDB for shares in Australian Forest Industries Inc. (AUFI). AUFI, in turn, announced that it also planned to acquire Rockbury Properties Limited's 40% interest in CDB (Simba Mines Inc., 2006a, b).

Industrial Minerals

Cement.—Cement in Angola was produced by two companies, Companhia de Cimento do Lobito S.A. (Secil-Lobito) and Nova Cimangola S.A. (Cimangola). The Cimangola cement plant, which is located in the city of Luanda, had an annual production capacity of 1.2 Mt/yr of cement and 540,000 t/yr of clinker. In 2006, the Government acquired Cimentos de Portugal, SGPS, S.A.'s 49% interest in Cimangola, which increased its total ownership in the company to 89% (AngolaPress, 2006). The Secil-Lobito plant, which is located in the city of Lobito, Benguela Province, had an annual production capacity of 250,000 t of cement and was owned by TecnoSecil Investimentos e Participações SARL of Portugal (TecnoSecil) (51%) and the Government (49%). In 2006, Secil-Lobito produced 173,000 t of cement, or about 70% of its nameplate capacity (Radio Nacional de Angola, 2007).

Diamond.—In Angola, alluvial and eluvial diamond deposits occur in the Provinces of Cunene, Huambo Bie, Kuando Kubango, Kwanza Sul, Lunda, Malange, Moxico Huila, and Uige. In the northern Provinces, diamond deposits extend into the Democratic Republic of the Congo [Congo (Kinshasa)]. About 700 kimberlite pipes containing reserves of about 50 million carats were known to exist in the country. Other deposits were thought to occur in coastal areas and offshore (Diamonds and Human Security Project, The, 2005, p. 2).

At least 10 companies were engaged in diamond exploration and (or) production in Angola in 2006; these companies included Alrosa Company Ltd. (ALROSA) of Russia; BHP Billiton World Exploration Inc. and New Millenium Resources N.L. of Australia; Daumonty Financing Company B.V. of Israel (which was part of the Lev Leviev Group of Israel); De Beers Group, Petra Diamonds Ltd., and Trans Hex Group Ltd. of South Africa; Odebrecht Mining Services Inc. (Odebrecht) of Brazil; Pangea Diamondfields plc of the United Kingdom; and SouthernEra Diamonds Inc. of Canada.

ALROSA was in the process of developing several projects in the country, which included bringing to design capacity the second phase of the Catoca ore-treatment plant; the commissioning of the first phase and the construction of the second phase of the Camatchia-Camagico ore-treatment plant; the completion of a hydroelectric powerplant on the Chicapa River; and the establishment of a joint-venture prospecting company with Endiama to develop the Cacolo project, which was for an area located in Lunda Norte Province that was prospective for diamond. The company agreed to invest an initial $14 million in the project (Mining Journal, 2006a; Alrosa Company Ltd., 2007, p. 34).

New Millenium was in negotiations to sell its 20% interest in three diamond concessions in Angola to an entity whose name was not disclosed reportedly for reasons of confidentiality (New Millenium Resources Limited, 2006).

Pangea mined diamondiferous gravels on a pilot mining basis at the Cassanguidi project, which is located 80 km east of Dundo and 30 km north of Nzaji in Lunda Norte Province. The company produced 25,416 carats from Cassanguidi during the period from February 2005 to March 2006. Stone sizes from the main pit ranged from 0.23 to 0.42 carat, and those from river bed gravels ranged from 0.29 to 0.35 carat. Operations at Cassanguidi were hampered during the fourth quarter of 2006 owing to seasonal rains and resulted in diamond production being less than expected for the quarter. The company reported that average diamond revenue from sales to Sodiam had been disappointing and that plans to develop the project further were to be deferred until there was a mechanism in place to ensure sales at market-related levels. The company also began a bulk-sampling program at the Lumuanza project in September 2006 and commissioned a 20-metric-ton-per-hour dense-medium separation plant. A regional exploration program was also begun to further evaluate the potential of the exploration permit area. The company, however, reported that high structural project overheads, financing ratios, and uncertainties regarding mechanisms to sell future output at market prices, among other things, did not justify continued exploration funding and that the company had decided to cease funding the project. Pangea held a 41% interest in the project through Sociedade Mineira do Lumuanza (Pangea DiamondFields plc, 2007a, b).

Mineral Fuels

Petroleum.—Petroleum was produced offshore the enclave of Cabinda, offshore in the Kwanza Basin north of Luanda, offshore the country's northern coast, and onshore near the city of Soyo. According to World Bank reports, most of the premier international oil companies have acquired interests in Angola, including British Petroleum (BP); Chevron Corp. and Exxon Mobil Corp. of the United States; Eni S.p.A of Italy;

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Royal Dutch Shell group of the Netherlands; and Total S.A. of France (World Bank Group, 2006, p. 33-34). Following the coming onstream of the Kizomba B project in Block 15, Angola was producing about 1.4 million barrels per day (Mbbl/d) of petroleum; its production was expected to continue to increase and to reach 1.8 Mbbl/d by 2007, 2.1 Mbbl/d by 2008, and 2.5 Mbbl/d by 2010 (Republic of Angola Embassy in the United Kingdom, 2006e).

The U.S. Energy Information Administration (2007) reported that Angola would likely see peak petroleum production in 2011 of 2.6 Mbbl/d followed by production declines if no new discoveries were made in the near future. The country consumed about 62,000 barrels per day (bbl/d) of petroleum in 2006; petroleum consumption was expected to increase, however, owing to ongoing and planned infrastructure projects. Proven petroleum reserves, the majority of which were located offshore, were reported to be 8 billion barrels.

Angola had one petroleum refinery, which produced about 40,000 bbl/d. In 2006, the Government signed a partnership agreement with China Petroleum Corporation (Sinopec) to build a second refinery in the city of Lobito, Benguela Province, with a production capacity of about 200,000 bbl/d. The proposed joint venture would operate the refinery under the name of Sonangol Sinopec International. The project was estimated to cost about $3.5 billion and was expected to be operational by 2010 (Republic of Angola Embassy in the United Kingdom, 2006a, d).

Outlook

According to the World Bank (2006, p. ii, xii), the Angolan economy will experience a massive oil revenue windfall with a concomitant fiscal gain during the next two decades or so. Diamond production is also projected to increase significantly. The World Bank suggests that, to a large extent, Angola's diamond sector remains secretive and that, if improvements are to take place in the industry, they will depend on the implementation of a predictable and transparent legal framework that adequately defines the rights and obligations of investors, the guarantee of tenure rights to investors upon obtaining a mining permit, and the Government's success in liberalizing the market and monitoring and regulating the sector.

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TABLE 1
ANGOLA: PRODUCTION OF MINERAL COMMODITIES[1]

Commodity		2002	2003	2004	2005	2006
INDUSTRIAL MINERALS						
Cement:[e]						
Hydraulic	thousand metric tons	597 [2]	700	740	1,315 [r, 2]	1,373 [2]
Clinker	do.	452 [2]	480	480	500	500
Diamond[3]	thousand carats	5,022 [4]	5,700 [4]	6,146 [r, 5]	7,079 [r, 5]	9,175 [2, 5]
Granite[e]	thousand cubic meters	1,500	1,500	1,500	1,500	1,500
Marble[e]	do.	100	100	100	100	100
Salt[e]	metric tons	30,000	30,000	30,000	30,000	35,000 [2]
MINERAL FUELS AND RELATED MATERIALS						
Petroleum:[e]						
Crude	thousand 42-gallon barrels	329,600	321,200	383,250 [2]	456,250 [2]	513,560 [2]
Refinery products[6]	do.	14,000	14,000	14,000	14,000	12,600

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised.
[1]Table includes data available through November 6, 2007.
[2]Reported figure.
[3]Production was approximately 90% gem and 10% industrial grade.
[4]Does not include smuggled production.
[5]Kimberley Process Certification Scheme.
[6]Includes asphalt and bitumen.

TABLE 2
ANGOLA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity
Cement		Nova Cimangola S.A. (Government, 89%, and private investors, 11%)	Luanda	1,200,000; 540,000 clinker.
Do.		Companhia de Cimento do Lobito (TecnoSecil Investimentos e Participações SARL, 51%, and Government, 49%)	City of Lobito, Benguela Province	250,000.
Diamond	thousand carats	Sociedade Mineira de Catoca Lda. (Endiama EP., 32.8%; ALROSA S.A., 32.8%; Daumonty Financing Company B.V., 18%; Odebrecht Mining Services Inc., 16.4%)	Catoca Mine, Lunda Sul Province, 36 kilometers south of Saurimo	6,500.
Do.	do.	Endiama EP., 51%; New Millenium Resources Ltd., 34%; Mombo Lda., 15%	Rio Lapi Mine, 45 kilometers northeast of Saurimo, Lunda Sul Province	240.
Do.	do.	Trans Hex Group Ltd., 35%, and Endiama EP., 40%	Fucauma Mine, northeastern Angola	120.
Do.	do.	Trans Hex Group Ltd., 32%, and Endiama EP., 40%	Luarica Mine, northeastern Angola	NA.
Do.	do.	Sociedade de Desenvolvimento Mineiro de Angola S.A.R.L. (Government, 50%, and Odebrecht Mining Services Inc., 50%)	Luzamba alluvial mine, Cuango Valley	NA.
Petroleum, refinery products	thousand 42-gallon barrels	Fina Petróleos de Angola (Total S.A., 64.1%, and Government, 34%)	Refinery, Luanda	14,600.
Steel		Chung Fong Holding Company, 51%, and Government, 49%	Relaunching of steel plant (under development)	NA.
Do.		Grupo Ferpinta of Portugal	Two pipe mills at Viana, 30 kilometers east of Luanda.	6,000.

NA Not available.

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The Mineral Industries of Benin, Burkina Faso, and Sao Tome e Principe

By Omayra Bermúdez-Lugo

BENIN

Benin's economy was based primarily on agriculture; cotton accounted for about 80% of export earnings and about 40% of the gross domestic product (GDP) (U.S. Department of State, 2007). The mineral industry, which was limited to the production of cement, clay, gold, and sand and gravel, did not play a significant role in the country's economy.

Structure of the Mineral Industry

Cement was produced by Ciments du Benin S.A., Société des Ciments d'Onigbolo, and Société des Ciments du Benin. These companies had a combined cement production capacity of 1.43 million metric tons per year (Mt/yr) (table 2). Gold was produced by artisanal miners from gold veins near the villages of Kwatena and Tchantangou, in the Atakora Mountains in northwestern Benin, and from alluvial sediments along the Perma River and its tributaries.

Commodity Review

Mineral Fuels

Petroleum.—Benin ceased petroleum production from its Seme oilfield in 1998; however, at least one company, Kosmos Energy LLC of the United States, explored for petroleum in 2006. Kosmos, through its subsidiary Kosmos Energy Benin HC, had a 40% working interest in an exploration license for Block 4, which is located about 30 kilometers (km) offshore Benin. Kosmo's venture partners were Kerr-McGee Benin Consortium S.A. (an affiliate of Kerr-McGee Corporation of the United States) (40%) and Petronas Carigali Overseas Sdn Bhd of Malaysia (20%). In 2006, the partners conducted a 1,472-square-kilometer (km^2) three-dimensional (3D) seismic survey of the Block's most prospective areas and were in the process of interpreting and reprocessing existing 3D seismic data (Kosmos Energy LLC, 2006).

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BURKINA FASO

In 2006, mining did not play a significant role in Burkina Faso's economy. Production of mineral commodities was limited to cement, dolomite, gold, granite, marble, phosphate rock, pumice and related volcanic materials, and salt.

Structure of the Mineral Industry

Gryphon Minerals Ltd. of Australia, Cluff Gold plc and Randgold Resources Ltd. of the United Kingdom, and Canadian companies Channel Resources Ltd., Etruscan Resources Inc., Goldbelt Resources Ltd., Goldcrest Resources Ltd., High River Gold Mines Ltd., Orezone Resources Inc., Riverstone Resources Inc., and Semafo Inc. continued to explore for gold throughout the year. Etruscan also explored for copper.

Commodity Review

Metals

Gold.—Cluff updated its bankable feasibility study for the Kalsaka gold project, which is located about 150 km northwest of the country's capital, Ouagadougou. Measured resources were estimated to be 6.5 million metric tons (Mt) at a grade of 1.6 grams per metric ton (g/t) gold, and indicated resources were estimated to be 2.7 Mt at a grade of 1.2 g/t gold. Following the completion of the bankable feasibility study, the company decided to continue with the development of the project and to bring it into production. In October, Ghana-based Banlaw Africa Ltd. was appointed as the mining contractor. Cluff held a 78% interest in the project; the remaining was held by IMARB Indústria Metalúrgica of Brazil (12%) and the Government (10%) (Cluff Gold plc, 2006; 2007, p. 10-11).

Etruscan continued with construction work activities at its 90% owned Youga gold property, which is located about 180 km southeast of Ouagadougou. Gold reserve estimates at the Youga Mine were reported to be 6.6 Mt at an average grade of 2.7 g/t gold. Commissioning of the mine was scheduled for mid-2007, and production was expected to be about 2,700 kilograms per year (kg/yr). As of November 30, 2006, the company had invested about $21.7 million in the project, had made purchase commitments of about $7 million for equipment and services, and had made additional purchase commitments of about $10.2 million for ongoing development activities (Etruscan Resources Inc., 2007, p. 3-4, 28, 32).

High River continued with the construction of the Taparko-Boroum open pit gold mine and mill facilities, which are located about 200 km northeast of Ouagadougou. The mine's first gold pour was scheduled for the second quarter of 2007. Initial production was expected to be about 3,100 kg/yr and to reach about 4,400 kg/yr by 2008. Measured and indicated resources were estimated to be about 12.6 Mt of ore at a grade of 2.77 g/t gold. The Taparko-Boroum Mine and mill would be operated by High River's subsidiary Société des Mines

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de Taparko (Somita S.A.). High River held a 90% interest in the project, and the Government held the remaining 10%. In addition to Taparko-Boroum, High River held other exploration licenses in the country, including the 1,000-km^2 Bissa Group permits, which are located about 80 km north of Ouagadougou. Measured and indicated resources for the Bissa Group were estimated to be about 12 Mt of ore at a grade of 1.72 g/t gold. The company invested about $2 million in exploration in 2006 and planned to invest an additional $8 million in 2007 to test identified target areas at the Bissa Group properties (High River Gold Mines Ltd., 2007, p. 6, 10-11, 16).

Zinc.—Aim Resources Ltd. (AIM) of Australia continued with the development of the Perkoa zinc deposit, which is located about 120 km west of Ouagadougou. In December 2005, Snowden Mining Industry Consultants completed a bankable feasibility study for Perkoa. Production was expected to be about 130,000 t/yr of concentrate at a grade of 53% zinc. Overall zinc recovery to concentrate was projected to be 93%, and contained zinc production, to average 68,000 t/yr; zinc concentrates would be transported by railway to the Port of Abidjan in Côte d'Ivoire and by road to the Port of Tema in Ghana. The first shipment of zinc concentrate was expected to be delivered in 2008. In its 2006 annual report, AIM announced that it had signed letters of intent with Louis Dreyfus Commodities Metals Suisse S.A., Votorantim Metais of Brazil, and Switzerland-based Xstrata plc to finalize offtake agreements for the production of zinc concentrates from Perkoa. Xstrata planned to process Perkoa concentrates through either the San Juan de Nieva zinc smelter in Spain or the Nordenham zinc smelter in Germany. According to AIM company reports, the Government had upgraded the road that leads to the mine and had constructed a dam that would provide water for the project. As of yearend, measured and indicated mineral resources at Perkoa were estimated to be 6.72 Mt at grades of 16.4% zinc and 35.4 g/t silver at a 5% zinc cutoff grade (Mining Journal, 2006; Aim Resources Ltd., 2007, p. 2, 5-6, 9).

In November, Goldcrest signed an earn-in agreement with Phelps Dodge Exploration Corporation of the United States whereby Phelps Dodge could earn up to a 70% interest in some of the properties for which Goldcrest held exploration permits in Burkina Faso. The agreement was contingent upon Phelps Dodge funding the projects through the completion of a bankable feasibility study. These properties included the Danyoro, the Malba, and the Souhouera copper-gold prospects (Goldcrest Resources Ltd., 2006).

In February 2006, Semafo awarded the engineering, procurement, and construction contract for the development of the Mana gold mine to Genviar Consulting Group Inc. According to the company's 2006 annual report, measured resources were estimated to be about 2.1 Mt at a grade of 1.99 g/t gold and indicated resources were estimated to be 2.5 Mt at a grade of 2.03 g/t gold. Average production, which was expected to begin in late 2007, was estimated to be about 3,900 kg/yr of gold for the first 3 years and about 3,000 kg/yr for the remaining life of the mine. The company approved a $3.5 million budget for the project for 2007 (Semafo Inc., 2006; 2007, p. 9, 18).

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SAO TOME E PRINCIPE

Sao Tome e Principe's economy was primarily based on agriculture; cocoa accounted for about 95% of exports. Other economic activities included fishing and processing of local agricultural products (U.S. Department of State, 2007). Mining did not play a significant role in the country's economy.

Production

Mineral production was limited to clay and volcanic rock; potential exists, however, for the development of the country's petroleum industry. All other mineral product requirements were imported.

Commodity Review

Mineral Fuels

Petroleum.—According to an International Monetary Fund (2006) report, indications of the existence of hydrocarbons in Sao Tome e Principe were first noted in 1974, but attempts by the Portuguese Colonial Administration to sign a concession agreement with Ball & Collins North Sea consortium (a predecessor of Premier Oil of the United Kingdom) were abandoned following the country's declaration of independence in 1975. Other attempts to start petroleum exploration during the late 1980s and 1990s also failed. In 2003, Nigeria (60%) and Sao Tome e Principe (40%) agreed to jointly operate an overlapping maritime boundary located about 200 km offshore Nigeria known as the Joint Development Zone (JDZ). Activities in the JDZ were to be overseen by the Joint Development Authority (JDA). The JDZ was divided into nine blocks, and a licensing round was opened for bids in 2004, which resulted in the award of Block 1 to a consortium made up of Chevron Corp. of the United States (51%), Esso Exploration and Production Nigeria-Sao Tome (One) Ltd. (40%), and Dangote Energy

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Equity Resources Ltd. (a joint-venture of the Dangote Group of Nigeria and Energy Equity Resources AS of Norway) (9%). The consortium signed a production-sharing agreement with the JDA in 2005 and, in January 2006, began drilling activities within the block. In May 2006, the consortium announced that it had encountered hydrocarbons in the Obo-1 exploration well in Block 1 and that it was in the process of evaluating reservoir rock and liquid samples to determine the next step of the appraisal process. Block 1 is located about 300 km north of Sao Tome e Principe and about 200 km south of the city of Port Harcourt in Nigeria (Chevron Corp., 2006).

A second licensing round for Blocks 2 through 6 was opened for bids in 2005. Energy Inc. of the United States (ERHC) won the rights to these blocks and, in March 2006, the company signed a series of production-sharing agreements with the JDA and several petroleum and gas companies, among which were Addax Energy Nigeria Ltd., Addax Petroleum (Nigeria offshore 2) Ltd., Addax Petroleum Resources Nigeria Ltd., Sinopec International Petroleum Exploration and Production Corporation Nigeria, and several other petroleum and gas companies whose names were not disclosed. Following inquires by the Petroleum Affairs Commission, the National Petroleum Council recognized deficiencies in the awarding process and ordered a formal investigation. The Attorney General, after concluding that the procedures used in selecting petroleum companies were flawed, recommended a restructuring of the procedures for future bidding rounds that would conform to international standards. The Attorney General's report also called for the reexamination of ERHC's preferential rights for Blocks 2, 3, 4, 5, and 6 within the JDZ (ERHC Energy Inc., 2006; International Monetary Fund, 2006).

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TABLE 1
BENIN AND BURKINA FASO: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Country and commodity		2002	2003	2004[e]	2005[e]	2006[e]
BENIN						
Cement, hydraulic		250,000	250,000	250,000	250,000	250,000
Clay[e]		19,000	21,000	21,000	21,000	21,000
Gold	kilograms	20 [e]	20	20	20	20
Gravel	cubic meters	26,000 [e]	28,500	29,000	29,000	29,000
BURKINA FASO[2]						
Cement[e]		30,000	30,000	30,000	30,000	30,000
Dolomite[e]	cubic meters	3,000	3,000	3,000	3,000	3,000
Gold	kilograms	209	770	1,125 [3]	1,397 [3]	1,571 [3]
Granite[e]	cubic meters	300,000	300,000	300,000	300,000	300,000
Phosphate rock:						
Gross weight		2,350	2,400 [e]	2,400	2,400	2,400
P_2O_5 content		650	650 [e]	650	650	650
Pumice and related volcanic materials[e]		10,000	10,000	10,000	10,000	10,000
Salt[e]		5,000	5,000	5,000	5,000	5,000
Stone, marble[e]		100,000	100,000	100,000	100,000	100,000

[e]Estimated; estimated data are rounded to no more than three significant digits.
[1]Table includes data available through July 13, 2007.
[2]In addition to the commodities listed, sand and gravel and other construction materials are produced, but information is inadequate to make reliable estimates of output.
[3]Reported figure.

TABLE 2
BENIN AND BURKINA FASO: STRUCTURE OF THE MINERAL INDUSTRIES IN 2006

(Metric tons unless otherwise specified)

Country and commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
BENIN				
Cement		Société des Ciments d'Onigbolo (Amida Group, 100%)	Onigbolo plant	450,000 cement; 500,000 clinker.
Do.		Ciments du Benin S.A. (Scancem International of Norway, 48.7%)	Cotonou plant	275,000 cement.
Do.		Société des Ciments du Benin (Government, 50%, and LaFarge Group, 50%)	do.	700,000 cement.
BURKINA FASO				
Gold	kilograms	Société des Mines de Taparko (High River Gold Mines Ltd., 90%, and Government, 10%)	Taparko-Boroum Mine (under development)	4,350.
Do.	do.	Cluff Gold plc, 78%; IMARB Indústria Metalúrgica, 12%; Government, 10%	Kalsaka Mine (under development)	NA.
Do.	do.	Etruscan Resources Inc., 90%, and Government, 10%	Youga Mine (under development)	2,700.
Do.	do.	Semafo Inc., 90%, and Government, 10%	Mana mine (under development)	3,900.
Zinc		Aim Resources Ltd., 90%, and Government, 10%	Perkoa Mine (under development)	130,000 concentrate.

NA Not available.

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The Mineral Industry of Botswana

By Harold R. Newman

Production of gem-quality diamond continued to be the foundation of Botswana's economy. In 2006, Botswana was the world's leading producer of diamond (by value) and the world's second ranked producer of diamond (in terms of volume) after the Russian Federation. The country's nickel production accounted for about 2% of world production. Copper, gold, and soda ash production also had significant, though smaller, roles in the national economy.

Minerals in the National Economy

In 2006, mining accounted for about 16% of Botswana's real gross domestic product, and about 50% of Government revenues were derived from mining and mineral-processing activity. About 14,575 people were employed in the mining industry. During the 2006-07 financial year, mineral revenues were about 13% higher than for the previous period. The increase in revenue was attributable to high sales volume during the year. The sources of mineral revenue in 2006 were diamond dividends, 75%; diamond royalties, 21.6%; and other sources, 3.4%. The Government concluded negotiations with De Beers SA to renew for an additional 25 years the mining leases for three of the four diamond mines operated by Debswana Mining Corp. All the country's rough-diamond output was either through Debswana Mining or through Tswapong Mining Co. (Pty.) Ltd. (Department of Mines, 2006).

Botswana's ninth national development plan and long-term goals to sustain economic growth include the promotion of value-added processing of the country's minerals and other natural resources. Also included is a commitment to expand downstream activities through the processing of a proportion of locally mined rough diamond output by domestic gem-cutting and polishing firms (Mining Magazine, 2006).

In 2006, the nominal value (in U.S. dollars) of minerals produced in Botswana exceeded that of 2005 by about 40%. Much of the increase was attributable to higher international mineral prices. Diamond, copper-nickel matte, and gold, in order of value, accounted for most of the increase (Bank of Botswana, 2006).

Production

In 2006, diamond production totaled about 34.3 million carats and production of semiprecious stones totaled 65,000 kilograms (kg). (The semiprecious stones were mainly varieties of agate and carnelian and production was not reported separately.) Total matte production was 64,368 metric tons (t) that contained 26,762 t of nickel, 24,555 t of copper, and 303 t of cobalt. Salt production declined to 151,595 t owing to some flooding in the pans, and soda ash production of 255,677 t was 9% lower than the previous year. Coal production totaled 962,427 t. In 2006, 80 companies extracted a total of 5,945 million cubic meters of clay, crushed stone, gravel, and sand compared with 3,006 million cubic meters in 2005. Consumption of these materials depended on construction industry activities. Although Botswana is endowed with other minerals, exploration for these other minerals was difficult to accomplish because a major portion of the country's geology is poorly exposed. Exploration is done mainly by geophysical analysis (Department of Mines, 2006).

Structure of the Mineral Industry

The Government maintained an equity position in most of the major mining companies, but the industry operated mostly on a privately owned free-market basis. Debswana Mining was the major diamond producer; Tati Nickel Mining Co. (Pty.) Ltd. (a subsidiary of LionOre Mining International Ltd. of Canada) produced copper and nickel; Monarch Goldfields Botswana (Pty.) Ltd. produced gold; and Botswana Ash (Pty.) Ltd. produced salt and soda ash. In addition to these major operations, a number of medium- and small-scale mines produced agates, aggregates, clay, and dimension stone. Information was not readily available for these operations. Major commodities and the companies that produced them are listed in table 2.

Commodity Review

Metals

Copper and Nickel.—In eastern Botswana, about 200 kilometers (km) south of Francistown, the smelter operated by Bamangwato Concessions Ltd. (BCL) of Botswana processed copper-nickel concentrate from its Selebi-Phikwe Mines. Under an agreement signed in 2001 by Centametall AG of Switzerland and Falconbridge International Ltd. of Barbados, BCL also toll-smelted concentrate from the Phoenix open pit mine, which was operated by Tati Nickel Mining. During 2006, BCL and Tati Nickel Mining produced 64,638 t of nickel-copper-cobalt matte. Centametall and Falconbridge shipped the nickel matte to the Falconbridge Nikkelverk, AS refinery in Norway and to RioZim Ltd.'s Eiffel Flats refinery in Zimbabwe (Department of Mines, 2006).

Several copper and nickel exploration projects were underway. African Copper plc had two copper projects: the Dukwe and the Matsitama deposits. Dukwe contains a near-production copper deposit and several exploration targets. The Government granted African Copper a mining license for the Dukwe project in 2006, which allowed the company to begin construction of the mine. The copper deposit had been traced by drilling and surface sampling for a total strike length of 4,370 meters (m), of which the central 2,000-m section was being considered for selective underground mining. Production at the mine was planned to begin in 2008. The Matsitama deposit covers 4,000 square kilometers (km^2) of prospective terrain and has four large mineralized areas containing a number of promising copper anomalies (Wright Reports, 2006).

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As noted above, Tati Nickel Mining operated the Phoenix open pit mine and the Selkirk underground mine in the Francistown area. Phoenix is a magmatic sulfide deposit hosted by a meta-gabbroic intrusion. Mineralization is a series of stacked subparallel, subhorizontal discontinuous massive sulfide lenses. Mineralogically, the ore is, on average, 70% pyrrhotite, 20% pentlandite, and 10% chalcopyrite. The grade of the massive sulfides can be as high as 8% nickel. The Selkirk Mine was closed in 2002, but was reopened in 2006 to allow pillar extraction and underground exploration of the ore body. Pillar extraction was expected to be completed in 2007 (LionOre Mining International Ltd., 2006).

Gold.—Iamgold Corp. of Canada acquired the Mupane gold mine from Gallery Gold plc in March 2006. The Mupane Mine, which was an open pit operation, was located about 30 km southwest of Francistown. In 2006, ore was sourced from the Tau open pit and from several small pits. Ore was processed in a 1-Mt/yr carbon-in-leach plant; a flotation circuit was commissioned in early 2006 to treat sulfides in the ore. Production from Mupane in 2006 was 2,325 kg. Exploration at Mupane was continuing to develop resources; increased resource estimates of the various prospects being investigated included the Molomolo and the Tekwane areas southeast of the mine (Iamgold Corp., 2006).

Industrial Minerals

Diamond.—Botswana is a participant in the Kimberley Process, which is an association of Governments of diamond producing and importing countries, commercial diamond firms, pan-industry associations, and nongovernmental organizations that have implemented a certification system for the international trade of rough diamond. The Kimberley Process is designed to prevent so-called "blood" or "conflict" diamond from being shipped through legitimate trading channels.

Debswana (a 50-50 joint partnership of Swiss-based De Beers Centenary AG and the Government) accounted for most of the diamond production in Botswana from four mines—the Damtshaa, the Jwaneng, the Letlhakane, and the Orapa. The open pits are medium-scale to very large-scale operations. The concentrate from the Damtshaa, the Letlhakane, and the Orapa Mines goes to a multistory Complete Automated Recovery Plant (CARP) at Orapa, and the concentrate from the Jwaneng Mine to a similar facility onsite. The Jwaneng CARP is part of the Aquarium project, which has a Fully Integrated Sort House to handle all diamond recovered by both CARPs. The Aquarium project is a fully hands-off recovery and sorting facility that uses x-ray and laser technology (Mining Technology, 2006).

Debswana broke its own diamond production record in 2006 by producing about 34.3 million carats. Debswana's diamond production included 17.3 million carats from the Orapa Mine, 15.6 million carats from the Jwaneng Mine, 1.1 million carats from the Letlhakane Mine, and 228,000 carats from the Damtshaa Mine. The Jwaneng Mine was the world's leading producer by value, and the Orapa Mine was the world's leading producer by volume (Debswana Diamond Co. (Pty.) Ltd., 2006b).

De Beers and the Government agreed that some of De Beer's Diamond Trading Company's (DTC) operations would move from London, United Kingdom, to Gaborone, Botswana. Local marketing of domestically produced gemstones was expected to help the local diamond cutting and polishing companies. The joint venture of the Government and DTC would sort and value all the diamond production of Debswana. In 2006, Botswana had only four diamond manufacturers, all sightholders of the DTC. The number of manufacturers could increase, however, as more diamond becomes available for cutting and polishing. More major diamond sorting operations were moving to Botswana (Jewellery News Asia, 2006).

Numerous other companies were exploring for diamond in Botswana. Active exploration operations included Firestone Diamonds plc, which was the leading holder of diamond exploration rights with 17,000 km^2 in the Jwaneng and the Orapa areas; Gcwihaba Resources (Pty.) Ltd. (a subsidiary of Tsodilo Resources Ltd.); Helio Resources Corp.; and the joint venture of Rio Tinto Mining and Exploration Ltd. and Trivalence Mining Corp.

Mineral Fuels

Coal.—Coal resources in the eastern part of Botswana have been estimated to total 17 billion metric tons. The quality of the coal was suitable for power generation. Botswana coal forms part of the Permian Gondwana coals that occur in the Karoo Basins of southern Africa, which developed during late Carboniferous to early Jurassic times. The Karoo basins host all coal deposits in the region. In Botswana, coal occurs in sedimentary rocks that form part of the volcanic and sedimentary deposits assigned to the Karoo Supergroup and largely occur in the centrally located Kalahari Karoo Basin that also extends into southeastern Namibia and western Zimbabwe (Department of Geological Survey, 2006).

Anglo American Corp. operated the Morupule Colliery at Palapye. Much of the company's coal production was sold to the adjacent Morupule Power Station of Botswana Power Corp. Moruple Colliery signed a contract with a South African company to construct a wash plant to produce washed coal. Construction was initiated at yearend 2006 and was expected to be completed by yearend 2007. Morupule's sale of graded coal was expected to more than double once the wash plant is in operation (Debswana Diamond Co. (Pty.) Ltd., 2006a).

Outlook

International interest in exploration for diamond and base and precious metals is expected to continue. The country's favorable geologic environment, mineral investment climate, low tax rates, and political stability are expected to continue to make Botswana a foreign mineral investment magnet. The Government encourages mineral value-added processing, but the paucity of water in landlocked Botswana has deterred large-scale industrial development. The country's small domestic market, the cost of transportation to ports in South Africa, and the rampant HIV/AIDS epidemic also limit the nation's attractiveness to investment by foreign manufacturers. High fuel costs would likely continue to affect the cost of transportation of Botswana's imports and exports adversely.

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Revenues from diamond operations are expected to continue to be the mainstay of the country's economy for the foreseeable future. Copper, gold, nickel, and soda ash production and processing also are expected to continue to be notable factors in the country's economy.

Given the country's extensive coal resources and projected regional power demand, Botswana has the potential to develop and support a small-scale coal-bed methane industry and additional coal-fueled electricity-generating plants that could supply power to the South African Power Pool through its land lines to South Africa.

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TABLE 1
BOTSWANA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004	2005	2006
Clay[e]		50,000	50,000	50,000	50,000	50,000
Coal, bituminous		953,081	822,780	913,087	984,876	962,427
Cobalt, smelter output, Co content of matte[3, 4]		269	294	223	326	303
Copper:						
Mine output, Cu content of ore milled[e]		27,750	31,380	29,460	31,300	24,300
Smelter output, matte, gross weight[3]		56,625	51,983	54,448	68,637	65,000 [e]
Smelter output, Cu content of matte[3, 4]		21,590	24,292	21,195	26,704	24,255
Diamond[5]	thousand carats	28,397	30,412	31,125	31,890	34,293
Gemstones, semiprecious[6]	kilograms	127,000	102,000	99,000	165,000	65,000
Gold[7]	do.	8	9	161	2,709	3,020
Nickel:						
Mine output, Ni content of ore milled		28,600 [e]	38,230	35,163	39,305	38,000 [e]
Smelter output, matte, gross weight[3]		56,625	51,983	54,448	68,637	64,368
Smelter output, Ni content of matte[4]		23,896	27,400	22,292	28,212	26,762
Salt[8]		315,259	229,432	208,319	243,945	151,595
Sand and gravel[9]	thousand cubic meters	2,401	1,485	2,330	1,906 [r]	4,812
Soda ash, natural		283,197	309,350	263,358	279,085	255,677
Stone, crushed	thousand cubic meters	1,201	1,060	1,219	1,100	1,134

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised.

[1]Table includes data available through October 31, 2007.

[2]In addition to commodities listed, platinum, palladium, and silver were produced, and exported in the nickel-copper-cobalt matte; copper and nickel cathodes also were produced at a pilot plant, but information was inadequate to estimate output.

[3]Smelter product was granulated nickel-copper-cobalt matte.

[4]Included some product from direct smelting of ore; that is, ore not reported as milled.

[5]Assumed to contain about 70% gem and near gem.

[6]Principally agate. Reported as sales.

[7]Reported as bullion; historically included silver estimated to be about 2%. Includes artisanal production.

[8]Byproduct of natural soda ash production.

[9]Includes clay (for brick and tile).

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TABLE 2
BOTSWANA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Clay[1]		Lobatse Clay Works (Pty.) Ltd. (Botswana Development Corp. and Interkiln Corp. joint venture)	Lobatse, 70 kilometers south-southwest of Gaborone	50,000.[e]
Do.		Makoro Brick and Tile (Pty.) Ltd.	Makoro, 10 kilometers south of Palapye	20,000.[e]
Coal		Morupule Colliery (Pty) Ltd. (Anglo American Corp. of South Africa Ltd. and related firms, 93.3%)	Morupule, 270 kilometers northwest of Gaborone	1,000,000.
Diamond	thousand carats	Debswana Diamond Co. (Pty.) Ltd. (Government, 50%, and De Beers Centenary AG, 50%)	Jwaneng Mine, 115 kilometers west of Gaborone	12,000.
Do.	do.	do.	Orapa Mine, 375 kilometers north of Gaborone	13,000.
Do.	do.	do.	Letlhakane Mine, 350 kilometers north of Gaborone	1,000.
Do.	do.	do.	Damtshaa Mine (opened late 2002)	670.
Do.	do.	Tswapong Mining Co. (Pty.) Ltd. (De Beers Prospecting Botswana Ltd., 85%, and Government, 15%)	Tswapong Mine, 275 kilometers northeast of Gaborone	3.
Gemstones, semiprecious	kilograms	Agate Botswana (Pty.) Ltd.	Processing plant at Pilane, 45 kilometers north of Gaborone	60,000.
Gold	do.	Iamgold Corp.	Mupane Mine, near Francistown	3,100.
Nickel-copper-cobalt		Bamangwato Concessions Ltd. (BCL), (Government, 15%, and Botswana RST Ltd., 85%, of which LionOre Mining International Ltd., 12.65%)	Selebi-Phikwe Mines, 350 kilometers northeast of Gaborone	3,000,000 ore matte content (of which 30,000 nickel, 25,000 copper, 400 cobalt).
Do.		Tati Nickel Mining Co. (Pty.) Ltd. (LionOre Mining International Ltd., 85%, and Government, 15%)	Phoenix and Selkirk Mines, 23 kilometers east of Francistown	3,600,000 ore matte content (of which 15,000 nickel, 9,000 copper, 100 cobalt, 960 kilograms palladium, 145 kilograms platinum).
Do.		Masa Precious Stones (Pty.) Ltd.	Bobonong, east of Selebi-Phikwe	4,000.
Salt		Botswana Ash (Pty.) Ltd. (Government, 50%, and Anglo American plc, 50%)	Sua Pan, 450 kilometers north of Gaborone	650,000.
Soda ash		do.	do.	300,000.

[e]Estimated.
[1]For brick and tiles.

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The Mineral Industry of Burundi

By Thomas R. Yager

In 2006, Burundi's production of, gold, limestone, niobium (columbium) and tantalum ore and concentrate, peat, sand and gravel, tin ore, and tungsten ore was not significant in global terms. Burundi was not a globally significant consumer of minerals. Mining and energy accounted for 1% of Burundi's gross domestic product in 2005 (the latest year for which data were available) (International Monetary Fund, 2006, p. 80).

Production

Gold accounted for more than 97% of the reported value of mineral production. In 2006, gold production increased by 10% compared with that of 2005. The output of tin and tungsten increased sharply. In 2006, the production of tantalum decreased by 69%, and niobium (columbium), by 62%. Peat production was estimated to have continued to decline because of aging equipment (United Nations Office for the Coordination of Human Affairs, 2006; Damien Riragonya, Director General of Mines and Geology, Burundi Ministry of Energy and Mines, written commun., September 9, 2007).

Structure of the Mineral Industry

Small privately owned companies produced most of Burundi's gold, niobium (columbium), and tantalum. Artisanal miners produced tin and tungsten. The state-owned Office National de la Tourbe was the country's only producer of peat.

Commodity Review

Metals

Cobalt, Copper, and Nickel.—In April 2007, Argosy Minerals Inc. of Australia planned to discuss the continuation of its mining convention for the Musongati nickel deposit with the Government. The company expected to engage in metallurgical test work, a prefeasibility study, and a feasibility study at Musongati if negotiations were successful. Until April 2005, political instability prevented Argosy from conducting work at Musongati. Resources at Musongati were nearly 185 million metric tons (Mt) that graded 1.31% nickel, 0.17% copper, and 0.08% cobalt. The Nyabikere deposit had 46 Mt of resources that graded 1.45% nickel, and the Waga deposit, 35 Mt that graded 1.38% nickel (Songore, 1999; Argosy Minerals Inc., 2007, p. 2, 5).

Gold.—In 2006, International Gold Exploration AB (IGE) of Sweden acquired an exploration license at a gold deposit in the Mabayi-Butara area in northwestern Burundi. IGE planned to complete a prefeasibility study on gold mining within 2 years. The Government had carried out exploration at the gold deposits in the Mabayi-Butara area since 1998 (International Gold Exploration AB, 2007, p. 15).

Niobium (Columbium) and Tantalum.—The value of niobium (columbium) and tantalum exports amounted to less than 1% of Burundi's total exports in 2006 compared with about 3% in 2002. From 2002 to 2006, tantalum production declined by 80% (Banque de la République du Burundi, 2007).

Vanadium.—In 2006, IGE acquired an exploration license for the Mukanda vanadium deposit. IGE planned to start drilling and test mining, and to conduct a prefeasibility study in early 2007; the company planned to reach a decision about investment in a new mine by early 2009. Resources at Mukanda amounted to 9.7 Mt that graded 0.63% vanadium (Burundi Ministry of Energy and Mines, 1991, p. 25; International Gold Exploration AB, 2007, p. 15).

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TABLE 1
BURUNDI: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2002	2003	2004	2005	2006
Gold, mine output, Au content	kilograms	483	2,855	3,229	3,905	4,313
Niobium (columbium) and tantalum, ore and concentrate:						
Gross weight	do.	72,441	24,382	23,356	42,592	16,177
Nb content	do.	NA	4,300	4,598	8,384	3,200
Ta content	do.	14,500	5,769	5,038	9,188	2,868
Peat		6,977	4,580	4,643	4,871 r	4,000 e
Tin, mine output, Sn content		--	5	9	4	46
Tungsten, mine output, W content		--	13	8	94	238

eEstimated; estimated data are rounded to no more than three significant digits. NA Not available. rRevised. -- Zero.
[1]Includes data available through September 18, 2007.

TABLE 2
BURUNDI: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Cement	Burundi Cement Plant[1]	Bujumbura	20,000.
Gold	Machanga Ltd.	NA	NA.
Do.	Burundi Mining Corp.	Masaka	18,300 ore processing.
Do. kilograms	do.	do.	33 gold.
Niobium (columbium) and tantalum	Asyst Mines, Comptoirs Miniers d'Exploitations du Burundi S.A., Hamza, and Habonimana	Kayanza and Kirundo Provinces	NA.
Peat	Office Nationale de la Tourbe	Highland Bogs	20,000.
Tin	Artisanal miners	Murehe	NA.
Tungsten	do.	do.	NA.

NA Not available.
[1]Has not operated since 1996.

TABLE 3
BURUNDI: MINERAL RESOURCES IN 2006[1]

Commodity	Deposit	Tonnage	Grade	Mineral content
Cobalt, copper, and nickel	Musongati	185 Mt	1.31% Ni; 0.08% Co; 0.17% Cu	2.4 Mt Ni; 150,000 t Co; 310,000 t Cu.
Do.	Nyabikere	46 Mt	1.45% Ni; 0.031% Co; 0.012% Cu	670,000 t Ni; 14,000 t Co; 5,500 t Cu.
Do.	Waga	35 Mt	1.38% Ni; 0.048% Co; 0.028% Cu	480,000 t Ni; 17,000 t Co; 9,800 t Cu.
Gold	Masaka	8 Mt	1.8 g/t	14 t.
Do.	Other deposits in Muyinga Province	NA	NA	45 t
Kaolin	Vyerwa	16 Mt	NA	NA.
Do.	Matongo	2.7 Mt	NA	NA.
Limestone	do.	1 Mt	NA	NA.
Peat	Akanyuru Valley	NA	NA	36 Mt.
Vanadium	Mukanda	9.7 Mt	0.63% V	61,000 t V.

NA Not available.
[1]Abbreviations used in this table for commodities include the following: Co--cobalt; Cu--copper; Ni--nickel; and V--vanadium. Abbreviations used in this table for units of measurement include the following: Mt--million metric tons; t--metric tons; and g/t--grams per metric ton.

Sources: Burundi Ministry of Energy and Mines, 1991; Burundi mineral resources—An investment brochure: Bujumbura, Burundi, Burundi Ministry of Mines and Energy, 41 p.
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The Mineral Industries of Cameroon and Cape Verde

By Harold R. Newman

CAMEROON

The mineral resources mined in Cameroon in 2006 were quite limited. Although the mining sector had not been a priority of the Government in the past, that appeared to be changing. The Government was reviewing its Mining Code with the intent of decreasing the state's role in mining operations and discretionary powers with respect to those operations. All mineral resources belong to the state. Prospecting, exploration, and mining activities for any mineral deposit were regulated by permit.

Production

The petroleum sector was the most significant segment of Cameroon's mineral industry, and petroleum products were the main export items. Other mineral commodities produced in the country were cement, clay, modest amounts of diamond and gold that were produced by artisanal miners from alluvial placer deposits, limestone, marble, pozzolana, primary aluminum, and sand. A variety of industrial minerals and other construction materials, such as aggregates, gypsum, and stone, were also produced. Cameroon's undeveloped mineral resources included bauxite, cobalt, gold from lode deposits, granite, iron ore, nepheline syenite, nickel, and rutile.

Hydromine Inc. of the United States was granted an exploration permit for the Minim-Martap and the Ngaoundal bauxite deposits in Adamaoua Province, where there was an estimated resource of 1,000 million metric tons (Mt) that averaged 46% aluminum oxide. Yekani S.A. of South Africa was awarded an exploration permit on the Fongo Tongo bauxite deposit near Dchang in west Cameroon (Mining Journal, 2006b).

Geovic Mining Corp. of the United States [a subsidiary Geovic Cameroon plc (GeoCam)] was planning to start mining cobalt, manganese, and nickel at the Nkamouna laterite deposit in southeastern Cameroon in 2009. Based on a 2006 prefeasibility study, GeoCam planned to produce 4,000 metric tons per year (t/yr) of cobalt and 3,000 t/yr of nickel from 525,000 t/yr of upgraded concentrates. Mining would be by open pit, and processing would be by atmospheric leaching after crushing, washing, and screening to upgrade the ore (Geovic Mining Corp., 2006).

Small-scale artisanal miners recovered gold in the eastern and northern parts of the country from alluvial and elluvial deposits. Annual gold production was estimated to be about 2,000 kilograms. Diamond was also produced throughout the country by small-scale artisanal miners. Numerous local operations produced industrial minerals.

Canadian Resources House Ltd. (CRH) received an exploration permit for the Lolodorf uranium property. The property is located in southern Cameroon and covers an area of 1,000 kilometers (km). CRH stated that mineralization at Lolodorf is hosted by a 2- to 5-km-wide zone of syenitic rocks that extend along a strike length of about 80 km (Mining Journal, 2006a).

Cameroon was considered to have abundant offshore natural gas resources and additional hydropower potential that remained to be developed. The country's petroleum reserves are located offshore in the Rio del Rey Basin, offshore and onshore in the Douala and Kribi-Camp Basins, and onshore in the Logone-Birni Basin in the northern part of the country. Cameroon's only refinery, which is located in the port city of Limbe, had a capacity to produce 45,000 barrels per day and was operated by Société Nationale de Raffinage (SoNoRa).

Structure of the Mineral Industry

The significant producers of mineral commodities in Cameroon were Compagnie Camerounaise de l'Aluminium (aluminum), Cimentaries du Cameroon (cement), and SoNoRa (petroleum). Table 2 is a list of the country's major mineral industry facilities.

More-extensive coverage of the mineral industry of Cameroon can be found in the 2004 and the 2005 U.S. Geological Survey Minerals Yearbook, volume III, Area Reports—International—Africa and the Middle East, which are available on the World Wide Web at http://minerals.usgs.gov/minerals/pubs/country.

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CAPE VERDE

Cape Verde is an archipelago of 10 islands and 8 islets located about 600 km off the western coast of Africa. Mining's contribution to the country's economy was minimal. Most of the country's mineral requirements were imported. Production of mineral commodities was limited to clay on the Islands of Boa Vista, Sal, and Sao Vicente; gypsum on the Island of Maio; limestone on the Islands of Boa Vista, Sal, and Santo Antao; pozzolana on the Island of Santo Antao; and salt on the Islands of Mindelo and Sal. Cape Verde was not a coal, natural gas, or petroleum producer.

More-extensive coverage of the mineral industry of Cape Verde can be found in the 2004 and the 2005 U.S. Geological Survey Minerals Yearbook, volume III, Area Reports—International—Africa and the Middle East, which are available on the World Wide Web at http://minerals.usgs.gov/minerals/pubs/country.

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TABLE 1
CAMEROON AND CAPE VERDE: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1,2]

(Metric tons unless otherwise specified)

Country and commodity[3]		2002	2003	2004	2005	2006
CAMEROON						
Aluminum metal, primary		67,000	77,200	85,900 [4]	86,977 [r,4]	87,000
Cement, hydraulic		936,969 [r,5]	948,943 [r,5]	1,032,438 [r,5]	1,000,000	1,000,000
Clay		23,066 [r,5]	24,881 [r,5]	15,734 [r,4]	9,811 [r,4]	10,000
Diamond	carats	5,000 [r,5]	5,500 [r,5]	12,000	12,000	12,000
Gold, mine output, Au content[6]	kilograms	700 [r,5]	700 [r,5]	1,500	18,895 [r,4]	20,000
Petroleum:						
Crude	thousand 42-gallon barrels	26,280 [4]	24,820 [4]	34,675 [4]	21,900 [7]	22,000
Refinery products	do.	12,000	12,000	12,000	12,000	12,000
Pozzolana, ash for cement		620,000	600,000	600,000	600,000	600,000
Sand and gravel		556,382	601,201 [4]	601,000	601,000	600,000
Sapphire	kilograms	1,000 [5]	1,000 [5]	1,000	1,000	1,000
Silica sand		12,408 [5]	13,927 [5]	14,000	14,000	14,000
Stone:						
Limestone		98,600 [5]	103,420 [5]	103,000	103,000	100,000
Marble		445 [5]	468 [5]	500	500	500
CAPE VERDE[8]						
Salt		1,600	1,600	1,600	1,600	1,600

[r]Revised.

[1]Estimated data are rounded to no more than three significant digits.

[2]Includes data available through April 2007.

[3]In addition to the commodities listed, a variety of industrial minerals and construction materials (aggregate, gypsum, and stone) are produced, and bauxite may be produced, but information is inadequate to make reliable estimates of output. The National Institute of Statistics of Cameroon reports salt production to be less than 1 metric ton per year.

[4]Reported figure.

[5]Reported by the National Institute of Statistics of Cameroon.

[6]From artisanal mining.

[7]Reported by the U.S. Energy Information Administration.

[8]Cape Verde also produced clay, gypsum, limestone, and pozzolana, but output is not reported, and available information is inadequate to make reliable estimates of output.

TABLE 2
CAMEROON: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity
Aluminum		Compagnie Camérounaise de l'Aluminium (Alcan Inc., 46.7%)	Plant at Edea	95
Cement		Cimentaries du Cameroon (Lafarge Group, 57%)	Plant at Bonaberi near Douala	1,200
Diamond	carats	Artisanal	Various locations	12,000
Gold	kilograms	do.	do.	1,500
Limestone		Cimentaries du Cameroon (Lafarge Group, 57%)	Figuil	275
Petroleum, refinery	barrels per day	Société Nationale de Raffinage (Government, 66%)	Refinery at Limbe	45,000
Pozzolana		Cimentaries du Cameroon (Lafarge Group, 57%)	Sud-Quest and Littoral Provinces	750

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The Mineral Industries of Central African Republic, Côte d'Ivoire, and Togo

By Omayra Bermúdez-Lugo

CENTRAL AFRICAN REPUBLIC

Central African Republic's mineral resource endowment included copper, diamond, gold, graphite, ilmenite, iron ore, kaolin, kyanite, lignite, limestone, manganese, monazite, quartz, rutile, salt, tin, and uranium. Of these commodities, only diamond and gold were produced in 2006; subsistence farming was the mainstay of the economy. The World Trade Organization (2007, p. 2, 6) estimated that the mining sector accounted for about 7% of the gross domestic product (GDP); rough diamond and timber were the country's leading export products.

According to the U.S. Department of State, Central African Republic has had a history of violence and unrest. The country has experienced four coups d'etat and many years of undemocratic rule since its independence in 1960. Recent threats to the country's stability included the presence of several rebel groups, which occupied four northeastern towns in October and November 2006 (Swan, 2007).

Production

Production of gold and diamond, which was mostly artisanal, came from the regions of Berberati, Haute-Kotto, and Haute-Sangha. In 2006, diamond production increased to about 420,000 carats from a revised 383,294 carats in 2005 (table 1); diamond exports, which were mainly destined for Europe and Israel, amounted to about 416,000 carats and were valued at $59 million.

Structure of the Mineral Industry

Production and trade of diamond and gold were overseen by the Bureau d'Evaluation et de Côntrole de Diamant et d'Or (BECDOR). BECDOR maintained the country's diamond and gold production database and assessed the value of diamond parcels that came from the various diamond-exporting companies (collectively known as bureaux d'achat) that operated in the country.

Commodity Review

Metals

Gold.—Axmin Inc. of Canada continued to explore for gold in the country. A prefeasibility study for the Passendro gold project was completed by GBM Ltd. of the United Kingdom in early 2006 and was followed by a feasibility study conducted by Senet (Pty) Ltd. of South Africa, which was commissioned during the third quarter of 2006. The prefeasibility study had envisioned an open pit operation with a gravity carbon-in-leach processing plant that would process about 3 million metric tons per year (Mt/yr) of ore with production estimated to be about 6,200 kilograms per year (kg/yr) of gold (reported as 200,000 troy ounces) (Axmin Inc., 2007, p. 1).

Other companies exploring for gold in the country included Prospero Minerals Corp. (formerly Corumel Minerals Corp., name changed in 2006), and Tamija Gold & Diamond Exploration Inc. of the United States, and London-based Pan African Resources plc.

Industrial Minerals

Diamond.—In 2006, Energem Resources Inc. of Canada continued to focus on the development of suitable diamond prospects within its Bangana, Bria, Kotto, and Quadda concessions (Energem Resources Inc., 2006). Vaaldiam Resources Ltd.'s plans to explore for diamond-bearing kimberlite pipes in the country continued to be on hold during the year as the company focused on other priority exploration areas in Brazil and Canada (Vaaldiam Resources Ltd., 2007, p. 17, 35). Other companies exploring for diamond included Pangea Diamondfields plc, which planned to invest $3.2 million in a bulk sampling plant for its Dimbi project concession area, and Gem Diamonds Ltd., which held exploration and mining permits for the Mambere River project near the town of Berberati.

Mineral Fuels and Related Materials

Petroleum.—Central African Republic did not produce mineral fuels in 2006 and depended upon imports for its energy requirements. United Reef Ltd. of Canada, which had obtained the rights to a petroleum exploration permit in the country through a farm-in agreement with Denver-based RSM Production Corp. (RSM) in 2004, was unable to continue with its exploration activities in 2006. The company declared "force majeure" following the lack of progress in resolving a contract dispute between RSM and the Government. The company's exploration permit was for the Doseo and the Salamat basins in the northern part of the country (United Reef Ltd., 2006, p. 1-4).

Uranium.—South African-based UraMin Inc. held a 90% working interest in 10 separate areas of uranium mineralization at Bakouma in south-central Central African Republic; the remaining 10% free-carried interest was held by the Government. The company began an exploration drilling program on the Patricia North deposit in August 2006 and planned to complete a feasibility study during the third quarter of 2008 (UraMin Inc., 2007).

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CÔTE D'IVOIRE

Côte d'Ivoire was a producer of cement, clay, diamond, gold, gravel and crushed stone, manganese, natural gas, niobium (columbium), crude petroleum and petroleum products, sand, sulfuric acid, and tantalum. Other mineral resources produced included bauxite, cobalt, copper, iron ore, nickel, and silica sand. The Ivorian economy was largely dependent on agriculture with coffee and cocoa as the principal export crops.

Production

Most mineral production data for 2005 and 2006 has been estimated with the exception of gold and crude petroleum. In 2006, gold production decreased modestly to 1,324 kilograms (kg) compared with 1,335 kg produced in 2005; crude petroleum production, however, increased by about 50.3% to 21.9 million barrels (Mbbl) compared with 14.6 Mbbl in 2005. Data on mineral production are provided in table 1.

Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities.

Commodity Review

Metals

Gold.—In 2006, gold production decreased to 1,324 kg from a revised 1,335 kg in 2005 (table 1). Production came from the Ity Mine, which was owned by French-based La Mancha Resources Inc. La Mancha acquired a 51% interest in the Ity Mine from Cie. Générale Des Matieres Nucleaires Group (COGEMA) of France in 2006. State-owned Société pour le Développement Minier en Côte d'Ivoire (SODEMI) held the remaining 49% interest (La Mancha Resources Inc., 2007, p. 7).

Equigold NL of Australia through its subsidiary Equigold Côte d'Ivoire S.A. completed a bankable feasibility study for the Bonikro gold project in July. Commissioning of the processing plant was scheduled for late March 2008, and first commercial production was expected byApril 2008. The estimated mine life of the project was 8 years at an estimated average production rate of about 3,700 kg/yr (reported as 120,000 troy ounces). Gold reserves at Bonikro were estimated to be 16 million metric tons (Mt) at a grade of 1.8 grams per metric ton (g/t) gold (Equigold NL, 2007a, p. 12-14; b).

Randgold Resources Ltd. of the United Kingdom advanced its Tongon project to the bankable feasibility stage in 2006; the company did not plan to make a decision until 2008 on whether or not to develop a mine. The company carried out an eight-hole diamond drilling program during the year and planned to conduct a 30,000-meter drilling program in 2007 (Randgold Resources Ltd., 2007, p. 2, 29-30).

Cluff Gold plc. of the United Kingdom completed a feasibility study for the reopening of the Angovia Mine. The company planned to submit an application for a mining permit to the Government, but no timeframe was provided as to when this would take place. Indicated and inferred mineral resources at Angovia were estimated to be about 6.15 Mt at a grade of about 1.7 g/t gold (Cluff Gold plc., 2007, p. 9).

Industrial Minerals

Diamond.—Kimberlites were known to occur at Kanangone, Seguela, and Tortiya; diamond was produced only from alluvial deposits at Seguela and Tortiya. In December 2006, the United Nations Security Council renewed until October 31, 2007, the ban it had imposed on rough diamond originating in Côte d'Ivoire (United Nations Security Council, 2006).

Mineral Fuels

Most of the country's oil and gas wells were located offshore. A consortium formed by Canadian Natural Resources Ltd. (CNR) (58.67%), Société Nationale d'Opérations Pétrolières de la Côte d'Ivoire (20%), and Tullow Oil plc of the United Kingdom (21.33%) produced natural gas and petroleum from the East Espoir and West Espoir oilfields. CNR (57.61%), Svenska Petroleum Exploration of Sweden (27.39%), and Petroci (15%) operated the Baobab oilfield, which began production in late 2005. The Baobab oilfield reached peak production of 52,000 barrels per day (bbl/d) during the first quarter of 2006, but owing to technical problems, production dropped to an average of about 25,000 bbl/d during the second half of the year. Average annual production at the East Espoir oilfield was 31,000 bbl/d. The West Espoir oilfield began production in mid-2006, and production was expected to peak at 13,000 bbl/d in 2007 (U.S. Energy Information Administration, 2007).

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TOGO

Togo was a producer of cement, clinker, diamond, gold, limestone, and phosphate rock. The country was also endowed with resources of bauxite, gypsum, iron ore, manganese, marble, rutile, and zinc. Agriculture, which accounted for about 42% of the GDP in 2006, was Togo's main economic activity. Most of the industrial activity in the country was limited to phosphate production (U.S. Department of State, 2007). The Ministère de l'Equipement, des Mines, de l'Energie et des Postes et Télécommunications was responsible for the administration of the mining sector. The International Fertilizer Group Togo, which was a 50-50 joint venture between Brifco Ltd. of France and the Government of Togo, was the company in charge of phosphate production.

Production

Production of diamond decreased by 31% to 28,200 carats from 41,000 carats produced in 2005; phosphate rock production increased by 22% to about 1.7 Mt from about 1.4 Mt produced in 2005. Data on mineral production are provided in table 1.

Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities.

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TABLE 1
CENTRAL AFRICAN REPUBLIC, CÔTE D'IVOIRE, AND TOGO: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Country and commodity		2002	2003[e]	2004[e]	2005[e]	2006[e]
CENTRAL AFRICAN REPUBLIC[2]						
Diamond[3]	carats	415,788 [r]	332,700 [4]	350,000	383,300 [r,4]	420,000 [4]
Gold	kilograms	16	7 [4]	7	10 [r,4]	10
CÔTE D'IVOIRE[5]						
Cement[e]		650,000	650,000	650,000	650,000	650,000
Columbite[e]	kilograms	130	130	130	130	130
Diamond	carats	306,500	230,000	300,000	300,000	300,000
Gold	kilograms	3,570	1,313 [4]	1,219 [4]	1,335 [r,4]	1,324 [4]
Gravel and crushed stone		550,000 [e]	600,412 [4]	659,097 [4]	660,000	660,000
Natural gas	million cubic meters	1,610	1,457 [4]	2,000 [4]	2,200 [4]	2,200
Petroleum:						
Crude	thousand 42-gallon barrels	5,457	7,506 [4]	8,125 [4]	14,574 [4]	21,900 [4]
Refinery products[e]	do.	19,000	19,000	19,000	19,000	19,000
Sand[e]		750,000	233,737 [4]	173,056 [4]	173,000	173,000
Sulfuric acid[e]		3,000	3,000	3,000	3,000	3,000
Tantalite[e]	kilograms	400	400	400	400	400
TOGO[6]						
Cement:[e]						
Clinker		1,000,000	1,200,000	1,200,000	1,200,000	1,200,000
Hydraulic[7]		800,000	800,000	800,000	800,000	800,000
Diamond	carats	NA	87,200	123,000 [r]	41,000	28,200
Limestone[e]		2,400,000	2,400,000	2,400,000	2,400,000	2,400,000
Phosphate rock, beneficiated product:						
Gross weight	thousand metric tons	1,271	1,471 [4]	1,115 [4]	1,350 [r]	1,650
P_2O_5 content[e]	do.	460	530	418 [4]	481 [r]	590 [4]

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised. NA Not available.
[1]Table includes data available through October 2007.
[2]In addition to the commodities listed, Central African Republic produced kaolin and quartz crystals, but information is inadequate to make reliable estimates of output.
[3]Production is approximately 80% gem quality.
[4]Reported figure.
[5]In addition to the commodities listed, Côte d'Ivoire produced clay, crushed granite, manganese, and stone, but information is inadequate to make reliable estimates of output.
[6]Togo also presumably produced gold, but output is not reported, and available information is inadequate to make a reliable estimate of output.
[7]Includes cement produced from imported clinker.

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TABLE 2
CÔTE D'IVOIRE AND TOGO: STRUCTURE OF THE MINERAL INDUSTRIES IN 2006

(Metric tons unless otherwise specified)

Country and commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
CÔTE D'IVOIRE				
Cement		Société des Ciments d'Abidjan	Abidjan plant	750,000.
Do.		Société Ivorienne de Ciment et Materiaux (Holcim Ltd.)	do.	500,000.
Do.		Société des Ciments du Sud-Ouest	San Pedro	100,000.
Gold		Société des Mines d'Ity [La Mancha Resources Inc., 51%, and Société pour le Développement Minier en Côte d'Ivoire (SODEMI), 49%]	Ity Mine	450,000 ore.
Petroleum, crude	thousand 42-gallon barrels	Canadian Natural Resources Ltd. (CNR), 57.61%; Svenska Petroleum, 27.39%; Société Nationale d'Opérations Pétrolières de la Côte d'Ivoire (Petroci), 15%	Baobab oilfield	17,520.
Do.	do.	Canadian Natural Resources Ltd. (CNR), 58.67%; Tullow Oil plc, 21.33%; Société Nationale d'Opérations Pétrolières de la Côte d'Ivoire (Petroci), 20%	East Espoir oilfield	6,700.
Do.	do.	do.	Lion and Panther oilfields	2,000.
Petroleum products	do.	Société Ivorienne de Raffinage	Abidjan	23,800.
TOGO				
Cement[1]		Ciments du Togo	Lome plant	800,000 cement.
Do.		West African Cement Company	Tabligbo	1,000,000 cement; 1,200,000 clinker.
Limestone[1]		Ciments de l'Afrique de l'Ouest	do.	2,400,000.
Phosphate rock		International Fertilizer Group Togo	Akoumape and Hahotue	2,000,000.

[1]Based on information available as of yearend 2005.

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The Mineral Industry of Chad

By Philip M. Mobbs

In 2006, Chad was the 10th ranked petroleum producer in Africa. Petroleum accounted for about 30% of Chad's gross domestic product and 45% of Government revenue. A new Petroleum Code was under consideration in 2006. The Petroleum Revenue Management Law (law No. 001/PR/99 of 1999) and amendments, such as law No. 002/PR/06 of 2006, defined the allocation of petroleum revenues. Mining of solid minerals, which was a negligible contributor to the national economy, was regulated by the Mining Code (law No. 011/PR/1995 of 1995) (BP p.l.c., 2007, p. 8).

Most formal international trade with landlocked Chad was funneled through seaports in Cameroon and Nigeria. Petroleum was exported via the Chad-Cameroon pipeline to an export terminal at Kribi, Cameroon. Informal trade moved across the borders into the neighboring central African countries of the Central African Republic, Libya, Niger, and Sudan. In 2005, which was the latest year for which data were available, exports of crude oil were valued at $2.7 billion[1] and accounted for 86% of total exports (Strauss and others, 2007, p. 138).

Production

Crude oil overshadowed the country's limited production of other mineral commodities, which included clay, gold, lime, limestone, salt, sand, soda ash (natron), and stone. Estimates of Chad's mineral production are provided in table 1.

Structure of the Mineral Industry

Small-scale local mining operations produced most of the country's solid minerals. International oil companies were involved in the exploration for and production of crude oil. In 2006, a law to establish the Société des Hydrocarbures du Tchad (SHTc) was approved by Parliament. SHTc is expected to participate in all petroleum production-sharing contracts. Esso Exploration and Production Chad, Inc. (Esso Chad) and Tchad Oil Transportation Co. S.A. operated a portion of about 200 kilometers (km) of the 1,070-km crude oil pipeline that originated in Chad and ended at an offshore terminal in Cameroon.

Commodity Review

Potential mineral exploration activity in Chad was inhibited by armed factions that engaged in hostilities along the eastern and the northern borders. Exploration also was inhibited in eastern Chad by social instability, which was associated with ongoing military action in the Darfur region of Sudan.

Mineral Fuels

Petroleum.—Esso Chad, which was a venture of Exxon Mobil Corp. of the United States (40% equity interest), Petronas Carigali Overseas Sdn. Bhd. of Malaysia (Petronas) (35%), and Chevron Overseas Petroleum Inc. of the United States (25%), operated five oilfields. Production from the Moundouli Field began in mid-2006. To offset unexpected reservoir conditions, Esso Chad continued to drill infill wells in the Bolobo, the Kome, and the Miandoum Fields. In 2006, 58 additional wells were drilled in these fields. Also in 2006, Esso Chad began the development of the Maikeri Field and started exploration drilling on the Mangara prospect (Esso Exploration and Production Chad, Inc., 2007, p. 9-11).

In August 2006, the Government threatened to expel Chevron and Petronas from Chad because of a dispute concerning an interpretation of the companies' income tax agreements. The Government proposed that SHTc acquire Chevron's and Petronas' combined 60% interest in Esso Chad. The dispute was settled in October when the international oil companies agreed to pay the Government about $300 million to cover negotiated tax liabilities (Xinhua Financial News, 2006).

EnCana Corp. of Canada negotiated the sale of its 50% interest in the Permit H concession to CNPC International Ltd. of Chad, which was a subsidiary of China National Petroleum Corp. The transfer of interest was expected to take place in early 2007.

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[1]Where necessary, values have been converted from Communauté Financière Africaine francs (XAF) to U.S. dollars (US$) at the average rate of XAF522.8=US$1.00 for 2006.

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TABLE 1
CHAD: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1,2]

(Thousand metric tons unless otherwise specified)

Commodity[3]		2002	2003	2004	2005	2006
Aggregate, sand, and stone		500	300	300	300	300
Gold, mine output, Au content	kilograms	150	150	150	150	150
Petroleum, crude[4]	thousand 42-gallon barrels	--	8,600	61,400	63,300	55,900
Salt		9	9	9	10	10
Soda ash, natron		12	12	12	12	12

-- Zero.

[1]Estimated data are rounded to no more than three significant digits.

[2]Table includes data available through August 9, 2007.

[3]In addition to the commodities listed, other industrial minerals and construction materials (clay, lime, and limestone) are produced, but information is inadequate to make reliable estimates of output.

[4]Reported figure. Production volume was metered on the floating, storage, and offloading vessel offshore Kribi, Cameroon.

TABLE 2
CHAD: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies and and major equity owners	Location of main facilities	Annual capacity
Gold	kilograms	Artisanal placer operations	Mayo Dala Department	150
Petroleum, crude	42-gallon barrels per day	Esso Exploration and Production Chad, Inc. (Exxon Mobil Corp., 40%; Petronas Carigali Overseas Sdh. Bhd., 35%; Chevron Overseas Petroleum Inc., 25%)	Bolobo, Kome, Miandoum, Moundouli, and Nya Fields, Doba Basin	175,000
Salt		Various local operators	Various locations	10,000
Soda ash		do.	Lake Chad, near Liwa	12,000

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THE MINERAL INDUSTRY OF CONGO (BRAZZAVILLE)

By Philip M. Mobbs

The Republic of Congo, which is also known as Congo (Brazzaville), is located in western equatorial Africa. The economy of the country was based largely on the production of petroleum; Congo (Brazzaville) ranked eighth among African crude oil producers in 2006 (BP p.l.c., 2007, p. 8).

The petroleum sector was regulated by the Code des Hydrocarbures (law No. 24-1994). Mining was regulated by the Code Minier (law No. 4-2005). Congo (Brazzaville) was a member of the Gulf of Guinea Commission, which was an intra-Governmental organization dedicated to fostering regional cooperation in the oil sector. Other members of the Commission included representatives from Angola, Cameroon, the Democratic Republic of the Congo [Congo (Kinshasa)], Equatorial Guinea, Gabon, Nigeria, and Sao Tome e Principe.

Minerals in the National Economy

The petroleum sector was estimated to account for 91% of the country's exports, 86% of Government revenues, and about 64% of the country's gross domestic product. In 2006, total merchandise exports were valued at $6.4 billion,[1] of which exports of crude oil and liquefied petroleum gas were valued at $5.8 billion. In 2005, total exports were valued at $4.9 billion, of which exports of crude oil and liquefied petroleum gas were valued at $4.3 billion. The increase in the value of exports was attributed to a combination of increased oil production and the increase in international crude oil prices. Official diamond exports effectively have been proscribed since 2004 when Congo (Brazzaville) was removed as a participant in the Kimberley Process. To discourage the trade in conflict diamond, Kimberly Process participant nations (which accounted for about 98% of the international diamond trade) were prohibited from trading diamond with nonparticipant nations (International Monetary Fund, 2007, p. 20, 23).

Production

In addition to petroleum and natural gas, cement, clays, diamond, gold, lime, sand and gravel, and stone were produced in Congo (Brazzaville). The redevelopment of coastal potash and salt deposits was expected to result in the resumption of production in the near future. Potash production had ceased in 1977 after the underground Holle Mine flooded.

Structure of the Mineral Industry

The mineral sector was regulated by the Ministre des Mines, des Industries Minières et de la Géologie. State-owned Société Nationale des Pétroles du Congo (SNPC) managed the Government's interest in petroleum and natural gas. Subsidiaries of SNPC included Congolaise de Raffinage (CORAF), which operated the petroleum refinery, and Société Nationale de Recherche et d'Exploration Pétrolière (SNREP), which was SNPC's operations (exploration and production) company.

Total Exploration & Production Congo (a subsidiary of Total S.A. of France) was the major private operator in the petroleum sector of Congo (Brazzaville). Other oilfield operators included Agip Congo S.A. (a subsidiary of Eni S.p.A. of Italy), Likouala S.A. of Congo (Brazzaville), Zetah Maurel & Prom Congo S.A. (a subsidiary of Etablissements Maurel et Prom S.A. of France), and the Perenco Group of France and the United Kingdom.

In 2006, Afren plc of the United Kingdom acquired Heritage Congo Ltd. and Heritage's interest in the La Noumbi license. Heritage's 25% interest in the Kouakouala A and B licenses was acquired by former joint-venture partners Burren Energy plc of the United Kingdom and Maurel & Prom.

PA Resources AB of Sweden acquired ADECO Congo BVI Ltd., which held 85% interest in the Marine XIV block. SOCO Exploration and Production Congo, which was a subsidiary of SOCO International plc of the United Kingdom, acquired 75% interest in the Marin XI block, in which SNREP held 15% interest and Africa Oil & Gas Corp, 10%. SOCO subsequently farmed out 18.75% of its interest to Lundin Petroleum AB and 18.75% interest to Raffia Oil S.A.R.L.

Commodity Review

The increased international mineral commodity prices and the new mining law attracted the interest of international exploration companies to the mineral resources of Congo (Brazzaville). Additional activity in the petroleum sector was noted in 2006, as well as initial prospecting and reconnaissance-stage exploration for diamond and gold. Other mineral occurrences in the country included bauxite, cobalt, copper, iron ore, lead, manganese, nickel, niobium (columbium)-tantalum, peat, silver, tin, tungsten, and zinc (L'Association "Investir en Zone Franc", undated).

Metals

Gold.—Artisanal miners in the Kele-Mbomo, the Kouilou-Mayonbe, and the Mossendjo-Chaillu areas were responsible for most of Congo (Brazzaville)'s gold production. In 2005, Explo-Mine Ltd. of the Czech Republic completed a placer gold evaluation project. In 2006, Compagnie Minière du Chaillu, which was a subsidiary of Mexivada Mining Corp. of Canada, started prospecting on the Malambani permit in the Mayoko greenstone belt, which is located about 370 kilometers (km) northwest of Brazzaville.

Magnesium.—Magnesium chloride was expected to be an initial coproduct of the proposed potash plant of MagMetals Inc. that was to be located about 15 km from Pointe Noire in the

[1]Where necessary, values have been converted from Communauté Financière Africaine francs (XAF) to U.S. dollars (US$) at the average rate of XAF527.7=US$1.00 for 2005 and XAF522.8=US$1.00 for 2006.

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Kouilou region. In 2006, MagMetals, which was a division of MagIndustries Corp., continued to evaluate the development of a 72,000-metric-ton-per-year (t/yr)-capacity magnesium smelter, which was to be built adjacent to the potash plant, and planned to begin a scoping study of the smelter project in 2007. Initial magnesium metal production was not expected for 2 or 3 years after the start of the construction of the smelter (MagIndustries Corp., 2006).

Industrial Minerals

Diamond.—Artisanal miners in the Kouilou, the Lekoumou, the Likouala, the Niari, and the West Cuvette regions were responsible for most of Congo (Brazzaville)'s diamond production. Terra Insight Corp., which was a subsidiary of CompuPrint, Inc. of the United States, was awarded a contract by Brazza Mining and Resources S.A.R.L. of Congo (Brazzaville) for the evaluation of kimberlite occurrences on the Mokabi permit in the Likouala area by interpreting remote-sensing data acquired by satellite.

Potash and Salt.—MagIndustries completed a positive Phase I feasibility study of the potash project on the Makola license area and subsequently initiated a bankable feasibity study (BFS) of the proposed 580,000-t/yr-capacity Kouilou potassium chloride plant. Completion of the BFS was expected in late 2007. MagMinerals Inc., which also was a division of MagIndustries, started a 12-well resource-definition drill program in the license area. The holes were completed as solution mining wells (MagIndustries Corp., 2006; 2007, p. 6-7).

Mineral Fuels

Natural Gas.—Most of the country's hydrocarbons were produced from offshore fields. Most associated natural gas produced in Congo (Brazzaville) was flared because of the lack of gas-gathering infrastructure. Some of the natural gas produced, however, was diverted to be used as fuel at the Djeno power station, which was located south of Pointe Noire; some was reinjected to maintain hydrocarbon reservoir pressure; and some was stripped of liquids (butane and propane) on the Nkossa offshore barge. MagMinerals proposed to acquire natural gas for use at its potash plant from companies that had previously flared their gas.

Petroleum.—New crude oil discoveries drilled by Total in 2006 included the Mobi Marine 2 prospect on the Moho-Bilondo permit and the Aurige Nord prospect on the Mer Très Profonde Sud license. Onshore, Maurel & Prom discovered oil on the Loufika prospect.

Outlook

The petroleum sector was expected to remain the cornerstone of the country's economy for the immediate future. Test production of the Loufika Field is expected to begin to flow in 2007, initial production from the offshore Moho-Bilondo Field is expected in 2008, and the deepwater Azurite prospect is expected to begin production in 2009. In 2010, national production of crude oil is expected to peak at slightly more than 105 million barrels; however, SNPC projected that by 2013, national production would decline to about 55 million barrels as production exhausts the recoverable reserves of older oilfields (Société Nationale des Pétroles du Congo, 2007).

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TABLE 1
CONGO (BRAZZAVILLE): ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

Commodity[3]		2002	2003	2004	2005	2006
Cement	metric tons	--	--	--	100,000	100,000
Diamond	carats	25,000	30,000	50,000	50,000	50,000
Gold, mine output, Au content	kilograms	100 r	175 r	160 r	120 r	100
Lime	metric tons	390	390	400	400	400
Liquid petroleum gas, propane	thousand 42-gallon barrels	3,000	1,900	919 [4]	766 [4]	2,960 [4]
Petroleum:						
Crude	do.	94,170 [4]	81,646 [4]	82,069 [4]	92,550 [4]	93,261 [4]
Refined	do.	2,800	2,700	2,700	3,000	3,500

rRevised. -- Zero.

[1]Estimated data are rounded to no more than three significant digits.

[2]Table includes data available through August 20, 2007.

[3]Crude construction materials (for example, clay, sand and gravel, and stone) were produced, but information is inadequate to make estimates of output. Natural gas is also produced, but output is flared, reinjected, or vented.

[4]Reported figure.

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TABLE 2
CONGO (BRAZZAVILLE): STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Thousand 42-gallon barrels unless otherwise specified)

Commodity	Major operating companies and and major equity owners	Location of main facilities	Annual capacity[e]
Cement metric tons	Société Nouvelle des Ciments du Congo (Société National Chinoise des travaux des ponts et chaussées, 56%, and Government, 44%)	Loutete	250,000
Diamond carats	Artisanal production	Kouilou, Lekoumou, Likouala, Niari, and West Cuvette regions	50,000
Gold kilograms	do.	Various locations	100
Liquefied petroleum gas	Total Exploration & Production Congo, 51%; Chevron Overseas (Congo) Ltd., 20%; Société Nationale des Pétroles du Congo, 15%; Energy Africa Congo Ltd., 4%	Nkossa Field, offshore	3,000
Petroleum:			
Crude	do.	do.	25,000
Do.	Total Exploration & Production Congo, 65%, and Agip Congo S.A., 35%	Kombi, Likalala, Tchibeli, and Tchibouela Fields offshore	25,000
Do.	Zetah Maurel & Prom Congo S.A., 48.6%; Tacoma Resources Ltd., 30.6%; Energy Africa Congo Ltd., 11%; Société Nationale des Pétroles du Congo, 8.8%	M'Boundi Field, onshore	20,000
Do.	Agip Congo S.A., 35.75%; Société Nationale des Pétroles du Congo, 35%; Chevron Overseas (Congo) Ltd., 29.25%	Kitina Field, offshore	15,000
Do.	Agip Congo S.A., 65%, and Total Exploration & Production Congo, 35%	Zatchi Field, offshore	12,000
Do.	Total Exploration & Production Congo, 55.25%; Agip Congo S.A., 29.75%; Société Nationale des Pétroles du Congo, 15%	Sendji and Yanga Fields, offshore	9,500
Do.	Agip Congo S.A., 65%; and Société Nationale des Pétroles du Congo, 35%	Djambala, Foukanda, and Mwafi Fields, offshore	7,300
Do.	Congorep (Perenco Group, 51%, and Société Nationale des Pétroles du Congo, 49%)	Emeraude and Yombo Fields, offshore	6,500
Do.	CMS NOMECO Congo [Société Nationale de Recherches et Production, 50%; Perenco Group, 25%; Nuevo Congo Co., 18.75%; Kuwait Foreign Petroleum Exploration Co. (K.S.C.), 6.25%]	Youmbo Field, offshore	6,100
Do.	Likouala S.A., 65%, and Agip Congo S.A., 35%	Likouala Field, offshore	3,800
Do.	Total Exploration & Production Congo, 65%, and Agip Congo S.A., 35%	Tchendo Field, offshore	3,000
Do.	Zetah Maurel & Prom Congo S.A., 66.67%, and Tacoma Resources Ltd., 33.3%	Kouakouala Field, onshore	500
Do.	Société Africaine Oil Corp.	Pointe-Indienne Field, onshore	50
Refined products	Congolaise de Raffinage (Société Nationale des Pétroles du Congo, 100%)	Pointe Noire	7,400

[e]Estimated; estimated data are rounded to no more than three significant digits.

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THE MINERAL INDUSTRY OF CONGO (KINSHASA)

By Thomas R. Yager

The Democratic Republic of the Congo [Congo (Kinshasa)] played a globally significant role in the world's production of cobalt and diamond. In 2006, the country's share of the world's cobalt production amounted to 38%; industrial diamond, 28%; and gem-quality diamond, 6%. Congo (Kinshasa) accounted for about 49% of the world's cobalt reserves. Copper and crude petroleum production also played a significant role in the domestic economy. The country was not a globally significant consumer of minerals or mineral fuels (Olson, 2007a, b; Shedd, 2007).

Minerals in National Economy

The mining and mineral processing sector accounted for 13.2% of the gross domestic product, and the manufacturing sector, 4.5%. An estimated 700,000 artisanal miners were involved in diamond production; employment in diamond trading amounted to about 100,000 (International Monetary Fund, 2005, p. 48-49; 2007, p. 46).

Government Policies and Programs

The Parliament of Congo (Kinshasa) passed a new mining code in July 2002 that replaced Ordinance No. 81-013 of April 2, 1981. The new code promotes private sector development of the mining industry; the principal role of the Government with respect to mining is to promote and regulate the development of the industry. Mining rights are vested with the Government. Congo (Kinshasa) was a signatory to the Kimberley Process, which established a certification system in November 2002 to reduce the trade in conflict diamond.

Production

In 2006, the production of tungsten in Congo (Kinshasa) increased by 178%; zinc, 120%; copper, 34%; and silver, 26%. Cement output increased by 4% in 2006, but doubled from 2002 to 2006. Tantalum production declined by 58% in 2006; niobium (columbium), by 57%; tin, 22%; and diamond, 19%.

Structure of the Mineral Industry

La Générale des Carrièrs et des Mines (Gécamines), which was a state-owned company, produced cobalt and copper; other cobalt and copper mining companies were privately owned. The cement producers Interlacs and Lukala Cements Co. were privately owned. The Government held an 80% share in the large-scale diamond producer Société Minière de Bakwanga (MIBA). Artisanal and small-scale miners accounted for most of the diamond, gold, niobium (columbium), tantalum, tin, and tungsten production in Congo (Kinshasa). Artisanal and small-scale miners also played a significant role in the country's cobalt mine production.

Trade

Exports were estimated to be about $2.32 billion in 2006, and imports, $2.74 billion. Diamond accounted for 38% of total exports; crude petroleum, 25%; cobalt, 16%; and copper, 11%. Other mineral exports included gold, niobium (columbium), tantalum, tin, tourmaline, and tungsten. The share of diamond in total exports declined from nearly 53% in 2001; the shares of cobalt and copper increased from 8% and 4%, respectively. From 2001 to 2006, diamond exports nearly doubled in value, but cobalt and copper exports increased at a faster rate because of higher prices and increased production. Petroleum products accounted for nearly 6% of total imports in 2006 (International Monetary Fund, 2007, p. 68-69).

Commodity Review

Metals

Cobalt and Copper.—First Quantum Minerals Ltd. of Canada produced copper ore from the Lonshi Mine; the company shipped its ore across the border with Zambia to the Bwana Mkubwa solvent extraction-electrowinning facility. Reserves at the Lonshi Mine were likely to be depleted in 2008 (First Quantum Minerals Ltd., 2007, p. 8, 11).

In April 2006, First Quantum started construction of a new mine at the Frontier copper deposit. The company planned to produce an average of 73,000 metric tons per year (t/yr) of copper during the 19-year life of the mine starting in the third quarter of 2007. The capital costs of the mine were expected to be $226 million (First Quantum Minerals Ltd., 2007, p. 8).

First Quantum purchased Adastra Minerals Inc. of the United Kingdom in May 2006; Adastra held a 65% interest in the Kolwezi Tailings project. First Quantum was considering the development of a plant with an initial production level of 35,000 t/yr of copper and 5,800 t/yr of cobalt; production could be expanded to 105,000 t/yr of copper and 17,400 t/yr of cobalt in a subsequent phase. The company planned to complete an engineering study in 2007 (First Quantum Minerals Ltd., 2007, p. 27).

Anvil Mining Ltd. of Australia operated the Dikulushi open pit copper-silver mine, which is located near Lake Mweru in Katanga Province. The company exported copper concentrates from the Dikulushi Mine to Namibia for smelting. Anvil produced 22,618 metric tons (t) of copper in 2006 compared with 17,816 t in 2005; silver production increased to 67,633 kilograms (kg) from 53,553 kg. Open pit mining ceased in November 2006; the company planned to mill ore from stockpiles until the planned completion of a new underground mine in the fourth quarter of 2007. Anvil expected production to be 20,000 t of copper and 56,000 kg of silver in 2007. The life of the underground mine was expected to be 6 years (Anvil Mining Ltd., 2007a, p. 3, 7).

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Anvil was engaged in a joint-venture agreement with Gécamines and DeMoura Enterprises to mine the Kulu deposit. In 2006, production at Kulu increased to 19,956 t of copper from 1,361 t. In 2007, copper output was expected to be about 16,000 t. Anvil planned to complete an electric arc furnace at Kulu for the production of black copper ingots with a grade of between 90% and 94% copper in the fourth quarter of 2007. The plant was expected to have a capacity of 15,500 t/yr of contained copper and to be fully operational in the first quarter of 2008 (Anvil Mining Ltd., 2007a, p. 8-9).

Anvil held a 95% interest in the mining rights for the Kinsevere and the Nambulwa deposits in Katanga. In the second quarter of 2006, Anvil announced plans to complete the first stage of development at Kinsevere, which included an open pit mine and two electric arc furnaces, in the second half of 2007. The Kinsevere project was expected to produce between 23,000 and 25,000 t/yr of black copper ingots. Anvil planned to complete a feasibility study of the second stage of the project in the second quarter of 2007. Depending on the results of the study, Anvil could build a solvent extraction-electrowinning plant with a capacity of 60,000 t/yr. The combined production from the Dikulushi, the Kinsevere, and the Kulu Mines was expected to be 60,000 t in 2008 and nearly 100,000 t in 2010 (Anvil Mining Ltd., 2007a, p. 10; 2007b, p. 8).

Gécamines and its joint-venture partners produced 36,000 t of copper in 2006 compared with 26,000 t in 2005 and 38,000 t in 2001. The company's production was inhibited by aging equipment; a lack of investment, fuel, and spare parts; and poor infrastructure (International Monetary Fund, 2007, p. 51).

In the second half of 2006, Ruashi Mining SPRL (Metorex Ltd. of South Africa, 67%) started production of cobalt and copper from tailings near the Ruashi Mine. The company reached the full capacity of 10,000 t/yr of copper and 1,000 t/yr of cobalt by the end of 2006. Resources in the tailings stockpile amounted to 3.2 million metric tons (Mt) at grades of 1.86% copper and 0.35% cobalt. The life of the first phase of the project was likely to be about 4 years from 2006 (Mining Review Africa, 2007a).

The second phase of the project involved mining the Ruashi ore body, which had resources of 24.9 Mt at grades of 3.7% copper and 0.71% cobalt. Starting in January 2008, Ruashi planned to produce 45,000 t/yr of copper and 3,000 t/yr of cobalt. The life of the mine was expected to be more than 20 years from 2008 (Mining Review Africa, 2007a).

Nikanor plc started production at the Kananga and the Tilwezembe Mines in late 2006. By the end of the year, Nikanor had produced 6,500 t of cobalt and copper concentrate with an average grade of 18% copper and 5.5% cobalt. Kananga and Tilwezembe had planned capacities of 2,500 metric tons per day (t/d) and 2,000 t/d of ore, respectively (African Mining, 2007; Nikanor plc, 2007, p. 6-7).

Nikanor also planned to restart production at the KOV Mine. The company planned to build a new refinery at the mine to produce 250,000 t/yr of refined copper and 27,500 t/yr of refined cobalt. Nikanor could start production at the refinery by late 2009 and reach full capacity by the end of 2010. The cost of the refinery was estimated to be $714 million; the KOV Mine, $440 million; and related infrastructure, $126 million (Nikanor plc, 2007, p. 4, 7, 9).

Central African Mining and Exploration Company plc (CAMEC) of the United Kingdom started heap leaching operations at its Luita solvent extraction-electrowinning plant near Lubumbashi in 2006. The company planned to produce at a rate of 40,000 t/yr of refined copper, 3,000 t/yr of refined cobalt, and 3,000 t/yr of cobalt concentrate by the end of March 2008. CAMEC planned to increase production to 100,000 t/yr of refined copper and 12,000 t/yr of refined cobalt by the end of 2008 (Central African Mining and Exploration Company plc, 2006).

The Tenke Fungurume project was a joint venture between Phelps Dodge Corp. of the United States (57.75%), Tenke Mining Corp. of Canada (24.75%), and Gécamines (17.5%). In December 2006, Phelps Dodge gave conditional approval for construction of the first phase of the project. Final approval depended upon getting Government signatures for a previously negotiated power supply agreement. If Tenke Fungurume were to proceed, production was expected to begin at a rate of 113,000 t/yr of copper and 8,200 t/yr of cobalt in late 2008 or early 2009. The life of the first phase of the project was estimated to be about 40 years. Capital costs of the project were estimated to be about $650 million (Tenke Mining Corp., 2006).

In April 2006, Katanga Mining Ltd. (Kinross Forest Ltd., 75%, and Gécamines, 25%) announced the completion of a feasibility study on restarting production at the Kamoto Mine near Kolwezi. Katanga planned to produce nearly 24,000 t/yr of copper and 900 t/yr of cobalt in the first phase of the project; production was expected to increase to 67,000 t/yr of copper and 2,800 t/yr of cobalt in the second phase. Katanga planned to start production in October 2007 (Katanga Mining Ltd., 2006; Arenson, 2007).

Copper Resources Corp. of South Africa planned to restart production at the Kinsenda copper mine by October 2007. The company planned to produce 40,000 t/yr of copper in concentrate. Africo Resources Ltd. completed a feasibility study on the Kalukundi copper-cobalt project in 2006. The company planned to produce 16,400 t/yr of copper and 3,800 t/yr of cobalt. TEAL Exploration and Mining Inc. planned to open a furnace with the capacity to produce 5,000 t/yr of blister copper starting in mid-2007. The furnace would process ore from artisanal miners currently working on TEAL's Kalumines property. TEAL was conducting exploration at Kalumines and a feasibility study on a mine with a capacity of 30,000 t/yr copper (Arenson, 2006; Mining Review Africa, 2007b).

George Forrest International S.A. and its joint-venture partners produced cobalt and copper at the Luiswishi open pit mine and La Société pour le Traitement du Terril de Lubumbashi's (STL) tailings treatment plant in Lubumbashi. From 2004 to 2006, cobalt production amounted to nearly 4,000 t/yr at Luiswishi; output at Lubumbashi was about 5,000 t in 2006 (George Forrest International S.A., 2007, p. 10, 16).

Gold.—Artisanal and small-scale miners produced gold in Ituri Province and South Kivu Province in eastern Congo (Kinshasa). Gold exports from Ituri were estimated to be about 5,200 kilograms per year (kg/yr), and those from South Kivu, 4,800 kg/yr (Tegera and Johnson, 2007, p. 50, 56).

In August 2006, Moto Goldmines Ltd. of Australia completed a prefeasibility study on the Moto project in Ituri Province.

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The company and its joint-venture partners were considering the development of a new mine that would produce an average of 9,000 kg/yr. The life of the mine was expected to be 8 years. Moto planned to complete a feasibility study in mid- to late 2007. In November, Moto revised its estimate of the combined resources of the Moto project deposits to nearly 580 t of contained gold from 490 t. Resources at Chauffeur were estimated to be 278 t of contained gold; Karagba, 84 t; Pakaka, 44 t; Gorumbwa, 43 t; and other deposits, 128 t (Moto Goldmines Ltd., 2007, p. 9-12).

Banro Corp. of Canada held the Kamituga, the Lugushwa, the Namoya, and the Twangiza properties in eastern Congo (Kinshasa). In September 2006, the company revised its estimates of resources at Twangiza to more than 180 t of contained gold from 99 t based on a drilling program started in February. Resources at Lugushwa were estimated to be 85 t of contained gold; Namoya, 34 t; and Kamituga, 28 t (African Mining, 2006a, b).

Niobium (Columbium) and Tantalum.—The production of niobium (columbium) and tantalum in Congo (Kinshasa) has declined sharply in recent years. In 2006, production of niobium (columbium) declined to an estimated 12 t from nearly 390 t in 2003 and 790 t in 2002 because of the closure of the Lueshe pyrochlore mine in Rutshuru District and lower production of columbite-tantalite by small-scale and artisanal miners. The decline in tantalum prices and the increase in tin prices led to artisanal miners abandoning columbite-tantalite mining in favor of cassiterite (Johnson and Tegera, 2005, p. 30, 35-36, 49).

From 2002 to 2006, reported exports of columbite-tantalite from South Kivu Province decreased to 13 t from 493 t; exports from North Kivu Province increased to 39 t from 28 t during the same period. Société Minière du Kivu continued to export from stockpiles from 2004 to 2006 after the closure of the Lueshe Mine (Tegera and Johnson, 2007, p. 22-23, 51).

In 2006, Central African Resources SPRL (CAR) was upgrading a plant to treat columbite-tantalite at Kalima; the plant was partly installed in July. In a second phase of the project, CAR planned to install a refinery at Kalima (Arenson, 2006).

Tin.—Artisanal miners produced cassiterite at Manono in Katanga Province; Kalima and Punia in Maniema Province; the Bisuru Bibatama Mine near Masisi, and the Bisie Mines near Walikale in North Kivu Province; and Nyabibwe in South Kivu Province. The miners were involved in ownership disputes with the Government; the mines were owned by the local landowners under local customs and by the Government under the country's mining code. Mining and Processing Congo (MPC) of South Africa was awarded an exclusive exploration license for four areas that included the Bisie Mines in late September 2006. Subsequent disputes with artisanal miners were reportedly addressed in an agreement between MPC and local chiefs in late December that included preferential employment for local miners (Tegera and Johnson, 2007, p. 26).

Reported exports of cassiterite from North Kivu Province were 2,904 t in 2006 compared with 4,672 t in 2004 and 497 t in 2002. In South Kivu Province, reported exports were 2,974 t in 2006 compared with 2,892 t in 2004 and 871 t in 2002. In 2005 and 2006, tin production declined because of lower tin prices. About 75% of the reported exports from North Kivu Province were shipped through Uganda; the remainder was shipped through Rwanda (Johnson and Tegera, 2005, p. 49-50, 53; Tegera and Johnson, 2007, p. 22, 24).

Most of the companies that exported cassiterite from Congo (Kinshasa) shipped concentrates with a tin content of between 55% and 60%. MPC sold cassiterite to its sister company Metal Processing Association in Rwanda for further processing. Sodex Mines reportedly processed cassiterite concentrates to a tin content of 78% before export. In 2006, Sodex accounted for 27% of exports from North Kivu Province, and MPC, 15% (Johnson and Tegera, 2005, p. 50-52; Tegera and Johnson, 2007, p. 23-24).

In 2006, CAR was building a new tin smelter at Kalima in South Kivu Province. Some of the plant's equipment was from a disassembled tin smelter in Rwanda. CAR planned to build a smelter with a capacity of 5,000 t/yr and to sell its output to Metmar Trading (Pty) Ltd. in South Africa (Arenson, 2006).

Tungsten.—In 2006, the mining of wolframite (tungsten ore) was the strongest growth sector in the mineral industry of North Kivu Province; wolframite was also mined in South Kivu Province. From 2002 to 2006, reported wolframite exports from South Kivu Province increased to 574 t from 159 t, and those from North Kivu Province, to 401 t from 26 t (Tegera and Johnson, 2007, p. 22-23, 51).

Zinc.—STL produced zinc oxide dust at Lubumbashi. First Quantum and Kumba Resources Ltd. of South Africa planned to reopen the Kipuhsi zinc-copper mine in Katanga Province. The companies had an exclusive option to submit a proposal for redevelopment of the mine. In the third quarter of 2006, Gécamines cancelled its agreement with First Quantum and Kumba and announced that bidding had been reopened for the right to mine at Kipushi (Swindells, 2006).

Industrial Minerals

Diamond.—MIBA produced mostly industrial and near-gem-quality diamond at Mbuji-Mayi in Kasai-Oriental Province. In May 2006, Mwana Africa plc purchased Sibeka Group, which held a 20% equity interest in MIBA, from Umicore S.A. The company's production decreased to 2.51 million carats in 2006 from 5.8 million carats in 2005; the decline was partially attributable to conflict between MIBA and artisanal miners who reportedly made incursions onto the company's property. MIBA's production was expected to decline to less than 1.0 million carats in 2007 (Arenson, 2006, 2007).

Sengamines SARL (Oryx Natural Resources Ltd., 80%, and MIBA, 20%) operated a diamond mine that was located 40 kilometers southwest of Mbuji-Mayi in Kasai-Oriental Province. The company produced 302,033 carats in 2005. The mine was shut down in May 2005 because of fuel delivery problems. In April 2006, First African Diamonds Ltd. purchased Oryx's share in Sengamines. First African and MIBA agreed to change the company's name to Entreprise Minière de Kasai Oriental (EMIKOR) and to return EMIKOR to exploration status for as long as 18 months. The reopening of the mine depended on favorable results of a feasibility study (Arenson, 2005).

At the end of June 2006, Rockwell Ventures Inc. of Canada agreed to purchase Durnpike Investments (Pty) Ltd. of

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South Africa, which held an interest in the Kwango River project. Privately owned Congolese company Midamines SPRL held the exploration license for Kwango River; Durnpike had an agreement with Midamines to manage and carry out exploration and mining. Rockwell agreed to spend $7 million on a feasibility study of mining at the Kwango River project by the end of August 2007 (Rockwell Ventures Inc., 2006).

Artisanal miners produced diamond at Luozi in Bas-Congo Province; at Gbadolite, Kota-Koli, and Yakoma in Equateur Province; at Bafwansende and Kisangani in Haut-Congo Province; at Lubutu in Maniema Province; and at various operations in Bandundu, Kasai-Occidental, and North Kivu Provinces. Artisanal diamond output declined to about 26 million carats in 2006 from 26.8 million carats in 2005 (International Monetary Fund, 2007, p. 51).

BHP Billiton Ltd. of Australia and SouthernEra Diamonds Inc. of Canada were engaged in a joint venture to explore for diamond in Kasai Province. SouthernEra started a stream sampling program in late 2005; the company planned to complete the program by the end of the first quarter of 2007. In 2006, SouthernEra completed a stream sampling program at the Kabinda North project, which was a joint venture with Nyumba Ya Akiba SPRL. SouthernEra also explored at its Badibanga and Tshikapa alluvial projects (SouthernEra Diamonds Inc., 2007, p. 6-7).

Gravity Diamonds Ltd. of Australia held the Gunge, the Luebo, the Maniamuna, and the Penge concessions on the Kasai Craton. In 2006, the company engaged in a drilling program at Luebo. BRC Diamond Corp. of Canada started an airborne survey and a drilling program at its Kwango River project in Bandundu Province in June. DeBeers explored for diamond near Munkama and Tshimbulu. Dan Gertler International (DGI) had joint-venture exploration agreements with MIBA that covered 15,000 square kilometers (African Mining, 2006b, c; Arenson, 2006).

At the end of 2005, DGI opened the country's first diamond cutting and polishing plant at Kananga. The plant was operated by Examon Finance International, which was a subsidiary of DGI that was responsible for trading 80% of MIBA's production (Arenson, 2006).

Outlook

Production of cobalt, copper, gold, and tin in Congo (Kinshasa) was expected to increase substantially in the near future. Cobalt and copper production could increase because of the Frontier, the Kolwezi Tailings, the Kinsevere, the KOV, the Ruashi, and the Tenke Fungurume projects; gold, because of the Moto project; and tin, because of a new smelter proposed by CAR. The development of these projects depends heavily upon political and economic stability and favorable conditions in world markets. The outlook for gold and tin is particularly dependent upon political stability because of continued civil unrest in eastern Congo (Kinshasa).

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TABLE 1
CONGO (KINSHASA): PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2002	2003	2004	2005	2006[e]
METALS						
Cobalt:						
Mine output, Co content[e, 2]		14,600 r	14,800 r	20,200 r	24,500 r	28,400
Metal, Co content[3]		2,149	1,200	735	600	550 [4]
Copper:						
Mine output, Cu content		40,000 r	59,000 r	73,000 r	97,000 r	130,000
Smelter, electrowon (low grade)		10,000	8,000	20,000	20,000	20,000
Germanium	kilograms	3,500	2,500	2,500	2,500	2,500
Gold, mine output, Au content[e]	do.	12,400 r	8,900 r	10,500 r	9,000 r	10,000
Niobium (columbium) and tantalum:						
Columbite-tantalite concentrate:[5]						
Gross weight		521 r	113 r	74 r	124 r	52
Nb content[e]		120 r	26 r	17 r	28 r	12
Ta content[e]		140 r	30 r	20 r	33 r	14
Pyrochlore concentrate:						
Gross weight		1,346	733	--	--	-- [4]
Nb content[e]		670	360	-- [4]	-- [4]	-- [4]
Silver, mine output, Ag content	do.	2,108	35,501	32,953	53,553 r	67,633 [4]
Steel		150,000	158,000 r	145,000 r	110,000 r	104,000
Tin, mine output, concentrate:[5]						
Gross weight		1,368	2,411	7,564	6,748	5,878
Sn content[e]		800 r	1,400 r	4,500 r	4,500 r	3,500
Tungsten, mine output, concentrate:[5]						
Gross weight		187	236	42	342	975
W content[e]		100	120	20	180	500
Zinc, mine output, Zn content		6,000 r	8,000 r	8,000 r	7,500 r	16,500 [4]
INDUSTRIAL MINERALS						
Cement, hydraulic		265,000	331,000	402,500	511,000 r	530,000 [4]
Diamond:[6]						
Artisanal	thousand carats	16,174 r	19,141 r	21,646 r	26,839 r	26,030 [4]
Large-scale	do.	6,328 r	7,840 r	7,870 r	8,368 r	2,510 [4]
Total	do.	22,502 r	26,981 r	29,516 r	35,207 r	28,540 [4]
Lime[e]		25,000	25,000	25,000	25,000	25,000
Stone, crushed		194,000	203,000	205,000 r	210,000 r	217,000 [4]
Sulfuric acid[e]		80,000	80,000	15,000	15,000	15,000
MINERAL FUELS AND RELATED MATERIALS						
Coal, bituminous[e]		1,000	1,000	1,000	1,000	1,000
Petroleum, crude	thousand 42-gallon barrels	8,400	9,200	10,100	9,000 r	9,000 [4]

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. -- Zero.

[1]Table includes data available through October 9, 2007.

[2]Includes mine production and reprocessed tailings.

[3]Salable refined production only; excludes white alloy and matte.

[4]Reported data.

[5]Reported exports from North Kivu and South Kivu Provinces.

[6]An estimated 20% of total diamond is gem quality; the majority of production is from artisanal mining.

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TABLE 2
CONGO (KINSHASA): STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity[1]
Cement	Cimenterie Nationale SARL	Kimpese plant, 40 kilometers south of Kinshasa	318,000.
Do.	Cimenterie du Lukala (The Forrest Group, 80%)	Lukala plant near Kinshasa in Bas-Congo Province	360,000.
Do.	Interlacs (The Forrest Group, 98.7%)	Kabimba plant near Lubumbashi, Katanga Province	50,000.
Do.	Cemenkat [The Forrest Group and La Générale des Carrières et des Mines (Gécamines)]	Lubudi plant, between Likasi and Kolwezi, Katanga Province	200,000.
Coal	La Générale des Carrières et des Mines (Gécamines)	Luena Mine	800,000 bituminous coal.
Copper-cobalt	Gécamines East Group:		
Do.	La Générale des Carrières et des Mines (Gécamines)	Copper smelter at Lubumbashi[2]	150,000 blister copper.
Do.	La Société pour le Traitement du Terril de Lubumbashi (STL) [OM Group Inc. (OMGI), 55%; Entreprise Generale Malta Forrest SPRL (EGMF), 25%; La Générale des Carrières et des Mines (Gécamines), 20%]	Big Hill tailings and cobalt smelter at Lubumbashi	5,000 Co in a Cu-Co alloy; 3,500 Cu in a Cu-Co alloy.
Do.	Compagnie Minière du Sud Katanga [Enterprise Générale Malta Forrest SPRL (EGMF), 60%, and La Générale des Carrières et des Mines (Gécamines), 40%]	Luiswishi Mine near Lubumbashi	12,000 copper; 4,500 cobalt.
Do.	Gécamines Central Group:		
	La Société Minière de Kabolela et de Kipese SPRL (SMKK) [Melkior Resources Inc. of Canada, 60%, and La Générale des Carrières et des Mines (Gécamines), 40%]	Kabolela Mine near Likasi	NA.
Do.	Kababankola Mining Company (KMC) [Tremalt Ltd., 80%, and La Générale des Carrières et des Mines (Gécamines), 20%]	Kakanda and Kambove Mines near Likasi	NA.
Do.	La Générale des Carrières et des Mines (Gécamines)	Kamwale Mine	60,000 Cu; 1,200 Co.
Do.	do.	Luisha Mine	620,000 Cu; 20,000 Co.
Do.	do.	Kamoya C Mine	79,000 Cu; 7,100 Co.
Do.	do.	Kamoya S Mine	36,000 Cu; 11,000 Co.
Do.	do.	Kamatanda Mine	57,000 Cu; 4,000 Co.
Do.	do.	Kamfundwa Mine	400,000 Cu; 48,000 Co.
Do.	do.	Kambove concentrator	1,500,000 copper concentrates.
Do.	do.	FEP cobalt plant	1,200 cobalt cathodes.
Do.	do.	Shituru electrowinning copper-cobalt refinery at Likasi	150,000 copper cathodes.
Do.	do.	Panda reverberatory furnaces at Shituru	150,000 wirebar or anodes.
Do.	Gécamines West Group	DIMA-Kamoto concentrator at Kolwezi	8,000,000 ore.
Do.	do.	Luilu hydrometallurgical refinery and leach plant near Kolwezi	175,000 Cu and 8,000 Co in cathodes.
Do.	Compagnie Minière de Sakania SPRL (Comisa), (First Quantum Minerals Ltd., 100%)	Lonshi Mine, Katanga Province	50,000 copper.

See footnote at end of table.

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TABLE 2--Continued
CONGO (KINSHASA): STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity[1]
Copper-cobalt--Continued		Anvil Mining Ltd.	Dikulushi Mine	20,000 copper.
Do.		do.	Kulu Mine	16,500 copper.
Do.		Ruashi Mining SPRL (Metorex Ltd., 67%)	Ruashi tailings project	10,000 copper; 1,000 cobalt.
Do.		Nikanor plc	Kananga Mine	910,000 ore.
Do.		do.	Tilwezembe Mine	19,000 copper.
Diamond	carats	Société Minière de Bakwanga (MIBA) [Government, 80%, and Sibeka Group (which was owned by Mwana Africa plc), 20%]	Diamond mines at Mbujiimaya, Kasai-Oriental Province, and at Tshikapa, Kasai Occidental Province	10,000,000.
Do.	do.	Extensive artisanal operations	Various small-scale placer and alluvial operations in Kasaï Occidental Provinces, in Bandundu Province, at Bafwansende and Kisangani in Haut-Congo Province, at Lubutu in Maniema Province at Kota-Koli, Yakoma, and Gbadolite in Equateur Province), in North Kivu Province, and at Luozi in Bas-Congo Province	27,000,000.[e]
Gold	do.	Artisanal miners	South Kivu Province	4,800.
Do.	do.	Office des Mines d'Or de Kilo-Moto (Okimo)	Kilo-Moto Gold Mine near Bunia, Haut-Congo Province	NA.
Niobium and tantalum		Artisanal miners	North and South Kivu Provinces	NA.
Petroleum	42-gallon barrels	Muanda International Oil Co. (subsidiary of Perenco plc), and Congolaise des hydrocarbures	Kifuku, Kinkasi, Liawenda, Makelekese, Muanda, Nsiamfuma, and Tschiende onshore wells	5,480 crude.
Do.	do.	Muanda International Oil Co. (subsidiary of Perenco plc), 50%; Teikoku Oil Co. Ltd., 32.3%; ODS Ltd., 17.7%	GCO, Libwa, Lubi, Mibale, Moko, Motoba, Mwambe, and Tshlala offshore wells	3,650 crude.
Do.	do.	Société Congo-Italienne de Raffinage (SOCIR) (Government, 50%, and Agip SA, 50%)	Petroleum refinery at Muanda[2]	6,200 refined.
Silver	kilograms	Anvil Mining Ltd.	Dikulushi Mine	62,000.
Sulfur	do.	La Générale des Carrières et des Mines (Gécamines)	Sulfuric acids plant at Kolwezi and Shituru	NA.
Tin	do.	Artisanal miners	Manono in Katanga Province; Kalima and Punia in Maniema Province; Bisuru Bibatama Mine near Masisi; the Bisie Mine near Walikale in North Kivu Province; and Nyabibwe in South Kivu Province	NA.
Tungsten	do.	do.	North and South Kivu Provinces	NA.
Zinc	do.	La Société pour le Traitement du Terril de Lubumbashi	Big Hill tailings and cobalt smelter at Lubumbashi	15,000 zinc in zinc oxide.
Do.	do.	La Générale des Carrières et des Mines (Gécamines)	Kolwezi zinc leach plant and refinery	30,000.
Do.	do.	do.	Kolwezi zinc smelter	72,000.

NA Not available.
[1]Abbreviations used in this table for commodities include the following: Co--cobalt, and Cu--copper.
[2]Not operating in 2006.

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THE MINERAL INDUSTRY OF DJIBOUTI

By Thomas R. Yager

In 2006, the small East African country of Djibouti was a producer of salt and such construction materials as basalt. Djibouti's production and consumption of minerals were not globally significant.

Production

Salt production started on a semi-industrial scale at Lake Assal in 1998; Djibouti replaced Eritrea as Ethiopia's source of salt imports because of the war between Eritrea and Ethiopia. Output declined sharply in 2004 because of a 53% tariff that Ethiopia imposed in October 2003 on salt imports from Djibouti. In 2005 and 2006, production recovered because of the resumption of exports to Ethiopia (Banque Centrale de Djibouti, undated, p. 22).

Structure of the Mineral Industry

Salt production at Lake Assal was carried out by small privately owned companies. The number of active producers declined to 8 in 2004 (the latest year for which information was available) from 15 in 2000. From 1999 to 2004, Société du Lac, Société Moussa Ali, Société Saline de Djibouti, and Société Sel de Djibouti accounted for 76% of semi-industrial production. At Doraleh, artisanal miners produced about 8,400 metric tons per year (t/yr) of salt (Ministère de l'Economie, des Finances et de la Planification, undated).

Commodity Review

Industrial Minerals

Salt.—Domestic salt consumption amounted to between 10,000 and 12,000 t/yr; most of Djibouti's salt production was exported to Ethiopia. In 2004, salt exports amounted to 1% of Djibouti's total exports compared with 8% in 2003 (Banque Centrale de Djibouti, undated, p. 50; Ministère de l'Economie, des Finances et de la Planification, undated).

Djibouti reportedly planned a new project to increase salt production and exports. The new project involved increasing production by 1.2 million metric tons per year; salt was expected to be exported to markets in Europe and Japan. The cost for the project was estimated to be $2 million. Development of the project depended upon upgrades to road and harbor infrastructure and the availability of a power source (Banque Centrale de Djibouti, undated, p. 22).

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TABLE 1
DJIBOUTI: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity	2002	2003	2004	2005	2006
Salt					
Industrial producers	162,263	128,494	17,745	70,000 [e]	130,000 [e]
Artisanal producers[e]	8,400	8,400	8,400	8,400	8,400
Total[e]	171,000 [r]	137,000 [r]	26,000 [r]	78,000 [r]	138,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised.
[1]Table includes data available through May 11, 2007.

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TABLE 2
DJIBOUTI: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity	Major operating companies[1]	Location of main facilities	Annual capacity[e]
Salt	Société Sel de Djibouti	Mines at Lake Assal	52,000
Do.	Société du Lac	do.	42,000
Do.	Société Moussa Ali	do.	34,000
Do.	Société Saline de Djibouti	do.	21,000
Do.	Société Mont Goda	do.	18,000
Do.	Société Mahad	do.	13,000
Do.	Société Kalou	do.	11,000
Do.	Société Mont Garbi	do.	4,000
Do.	Artisanal miners	Mines at Doraleh	8,400

[e]Estimated.
[1]Capacity for producers at Lake Assal based on maximum production in 1 year between 1999 and 2004.

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The Mineral Industry of Egypt

By Harold R. Newman

Petroleum and petroleum products were the leading mineral commodities produced in 2006 as the mineral fuels sector continued to be a vital segment of and a major contributor to the economy of Egypt. Government efforts with respect to the mineral industry were focused mainly on the further development of the country's mineral resources. Geologic studies have identified resources of different minerals, such as gold, granite, marble, and phosphate rock. A national plan was being prepared to develop investment opportunities in mineral reserves.

Minerals in the National Economy

Egypt was a significant producer of natural gas and petroleum. The energy sector was the leading industrial activity in the country and accounted for 12% of the country's gross domestic product (GDP). Exports of petroleum and related products amounted to more than $2.7 billion in fiscal year 2005 (the latest year for which data were available). Egypt was encouraging the production of natural gas. Natural gas accounted for almost 50% of all hydrocarbon usage in Egypt (U.S. Department of State, 2006).

Government Policies and Programs

The Ministry of Industry and Mineral Resources, through the Egyptian Geological Survey and Mining Authority (EGSMA), was the Government agency responsible for regulating the exploration for and the prospecting and exploitation of all mineral deposits in Egypt. The law that regulated the mining sector was the Mining and Petroleum Code law No. 66 of 1953. The Electricity and the Energy Ministries were the main Government agencies responsible for the energy sector.

Production

In addition to mineral fuels, Egypt also produced metals, including aluminum, ferroalloys, iron ore, secondary copper, and steel. The country also produced industrial minerals, including cement, construction materials, granite, gypsum, limestone, and raw materials for glass (table 1).

Structure of the Mineral Industry

Ownership of the mineral producing and processing facilities was a mix of Government and private. Natural gas, petroleum, and petroleum products plants were the predominate producers controlled by the Government. The Government continued with its efforts to partially privatize mining and metal assets. Table 2 is a list of the major mineral industry facilities.

Mineral Trade

Trade has played an important role in the Egyptian economy. The country was dependent upon export markets to generate income and upon imports for raw materials. The Governments of Egypt and Syria met in April 2006 in Cairo to discuss aspects of bilateral cooperation between the two countries in the natural gas and petroleum sectors and to develop a cooperative framework of signed accords on bilateral trade issues in trade fields (Arabic News, 2006).

Commodity Review

Metals

Gold.—Centamin Egypt Ltd. of Australia had a 160-square-kilometer (km^2) exploitation lease for the Sukari Hill gold project and was continuing with a feasibility study to upgrade the project. At yearend 2006, the resource at Sukari was estimated to be 242,672 kilograms (kg) of gold. Extraction was expected to be by open pit mining (Centamin Egypt Ltd., 2006).

Iron and Steel.—Egyptian Ferroalloys Co. (Efaco) produced ferroalloys with silicon content percentages that ranged from 45% to 75% purity; the 75% concentration was mostly in the ferrosilicon product. Silica fume was produced as a byproduct of ferroalloy production. Efaco operated four electrical furnaces with a capacity of 50,000 metric tons per year (t/yr) of ferrosilicon alloys and 17,000 to 20,000 t/yr of silica fume. The Government announced that 10 million shares that represented 100% of the capital shares would be directed to private investors through a bidding process by means of sealed envelopes (Ministry of Investment, 2006).

Magnesium.—Magnesium International Ltd. (MIL) of Australia announced that it had signed a memorandum of understanding with El Nasr Mining Co. to supply 200,000 t/yr of higher-than-40% grade magnesium oxide for the first phase of the Sokhna magnesium smelter. MIL's primary objective was to enter the magnesium industry through the development of a magnesium mine, smelter, and alloy plant at the Sokhna site with output of 108,000 t/yr of high-quality magnesium alloy (Magnesium International Ltd., 2006).

Tantalum and Tin.—Gippsland was continuing with development of its Abu Dabbab tantalum and tin project in a joint-venture project with EGSMA. Tantalum Egypt LLC was the operating company in which Gippsland and EGSMA each held a 50% interest. A study of the project by Lycopodium Engineering Pty Ltd. in 2004 was being updated to reflect current costs. The project was expected to produce 260 t/yr of tantalum pentoxide along with 1,500 t/yr of byproduct tin (Platts Metals Week, 2006).

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Industrial Minerals

Cement.—The Government moved to cap the country's rising cement prices, which were inflated by rising gas, fuel, and electricity costs. By mid-March, the price had risen to $66.50 per metric ton, significantly affecting local contractors. The move to cap cement prices seems to have had a positive effect on Egypt's construction industry. The Government limited the number of companies allowed to export cement and introduced a suggested ex-factory price cap of $50.70, a move that would pull the retail price down to $57.70 per metric ton. Eleven companies in Egypt produced about 38 million metric tons per year (Mt/yr) of cement, which was more than 40% more than its nearest neighbor, Saudi Arabia. Egypt accounts for more than one-quarter of the region's 146 Mt/yr of cement production capacity (Middle East Economic Digest, 2006b).

Nitrogen.—Alexandria Fertilizers Co. was developing plans for a major expansion of its plant at Abu Qir. The $600 million expansion, which was subject to the finalization of a feedstock agreement with Egyptian Natural Gas Holding Co., would add 2,000 metric tons per day (t/d) of ammonia and 3,300 t/d of granulated urea at the site by 2010 (Middle East Economic Digest, 2006a).

Mineral Fuels

Egypt was a transit corridor to the Persian Gulf and had strategic importance because of its operation of the Suez Canal by the Suez Canal Authority (SCA) and the Suez-Mediterranean (Sumed) Pipeline. The 3.1-million-barrel-per-day Sumed pipeline and the Suez Canal were two major routes for exports of oil from the Persian Gulf region to the Mediterranean. The Suez Canal generated a record $3.3 billion in revenue in 2005 (Egyptian State Information Service, 2006).

The Government continued to seek to attract more investments in natural gas, petroleum, and prospecting and extraction operations in southern Egypt. The petroleum sector signed 12 contracts with various companies and set aside $282 million for prospecting operations in a 220,000-km^2 area, which was equivalent to about 50% of the total area of the upper part of Egypt. The contracts involved drilling 46 oil wells (Alexander's Gas & Oil Connections, 2006b).

Natural Gas.—Most of Egypt's offshore discoveries have been natural gas, and natural gas was the fastest-growing mineral fuels sector in 2006. The International Egyptian Oil Company (a subsidiary of Eni S.p.a of Italy) was Egypt's leading natural gas producer. The company operated in the Gulf of Suez, the Nile Delta, and the Western Desert. The Government announced plans to double its natural gas exports within the next 5 years and to substantially boost reserves. The increase would be realized through expansion of the country's two liquefied natural gas plants and boosting sales through the Arab Gas Pipeline. The Government was also talking to the Governments of Bulgaria, Romania, Syria, and Turkey about integrating Egyptian gas exports into the planned 30-billion-cubic-meter-per-year Nabucco pipeline. In 2006, Egypt exported 17 billion cubic meters of natural gas that was valued at about $3 billion (Alexander's Gas & Oil Connections, 2006a).

Petroleum.—Egyptian petroleum production comes from four main areas: the Gulf of Suez (about 50%), the Western Desert, the Eastern Desert, and the Sinai Peninsula. Although the output of petroleum has declined, exploration activity in new areas could potentially result in the discovery of sufficient oil to slow the decline. The leading producer in the Gulf of Suez was the Gulf of Suez Oil Co. [a joint venture of Egyptian General Petroleum Corp. (EGPC) and BP Amoco Corp. of the United Kingdom]. The second ranked producer was Belayim Petroleum Co. which was a joint venture of EGPC and International Egyptian Oil Co. The third ranked producer was the Suez Oil Co. (U.S. Energy Information Administration, 2006).

In 2006, the Government announced the discovery of six gasfields and oilfields in the Gulf of Suez, the Eastern Desert, the Western Desert, and the Mediterranean Sea. These finds were expected to secure an additional 140 million barrels of oil and condensates. The thickness of the reservoirs containing oil and gas are between 60 and 75 meters. The new discoveries will be assessed and tested in preparation for putting them into production as soon as possible (Alexander's Gas & Oil Connections, 2006c).

Outlook

The Egyptian mineral fuels industry is expected to grow during the next 3 to 4 years, mainly as a result of the Government's recent restructuring of the energy sector following several natural gas discoveries. The Government is expected to continue to move forward with its policy to develop the country's hydrocarbon resources. The natural gas sector is expected to continue to expand. Although natural gas exports are likely to overtake petroleum exports in the near future, the presence of several foreign companies exploring for petroleum offshore Egypt in 2006 suggests the possibility of further development of the petroleum sector if new discoveries are made.

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TABLE 1
EGYPT: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Thousand metric tons unless otherwise specified)

Commodity		2002	2003	2004	2005	2006[p]
METALS						
Aluminum metal	metric tons	195,000	194,600 [3]	215,000	243,800 [3]	252,300 [3]
Copper, refined, secondary	do.	4,000	14,119 [3]	14,000	14,000	14,000
Iron and steel:						
Iron ore and concentrate		2,618 [3]	2,237 [3]	2,287 [r, 3]	1,599 [r, 3]	1,600
Metal:						
Pig iron		1,700	1,000 [3]	1,000	1,100 [3]	1,100
Direct-reduced iron		2,530	2,870	2,800	2,600	2,600
Steel, crude		4,316 [3]	4,398 [3]	4,500	5,600 [3]	5,500
Ferroalloys:						
Ferromanganese		30	30	30	30	30
Ferrosilicon		55	55	55	55 [r]	50
Manganese ore	metric tons	20,000	20,000	46,450 [r, 3]	22,971 [r]	16,500
Titanium, ilmenite		125	120 [3]	120	120	120
INDUSTRIAL MINERALS						
Asbestos	metric tons	2,000	2,000 [r]	--	--	--
Barite		500	500	500	500	500
Cement, hydraulic, all types		28,155 [3]	26,639 [3]	28,763 [3]	29,000	29,000
Clays:						
Bentonite		50	26 [3]	30	30	30
Fire clay		300	300	300	300	300
Kaolin	metric tons	260,000	260,000	295,430 [r, 3]	415,400 [r, 3]	416,000
Feldspar, crude	do.	350,000	350,000	178,249 [r, 3]	357,134 [r, 3]	360,000
Fluorspar	do.	500	500	891 [r, 3]	549 [r, 3]	550
Gypsum and anhydrite, crude		1,000 [r]	7,920 [r, 3]	7,634 [r, 3]	3,290 [r, 3]	3,300
Lime		800	800	800	800	800
Nitrogen:						
Ammonia, N content		1,839 [3]	1,790 [3]	1,652 [3]	1,640	1,800
Urea, N content		1,078 [3]	1,134 [3]	1,078 [3]	1,000	1,000
Phosphate:						
Phosphate rock		1,500	2,183 [3]	3,269 [r, 3]	2,144 [r, 3]	2,200
P_2O_5 content		434	630	948 [r]	622 [r, 3]	625
Sodium compounds:						
Salt		2,400	1,341 [3]	1,010 [r, 3]	1,200 [r]	1,200
Soda ash		50	50	50	50	50
Sodium sulfate	metric tons	2,500	2,500	2,500	2,500	2,500

See footnotes at end of table

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TABLE 1—Continued
EGYPT: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Thousand metric tons unless otherwise specified)

Commodity		2002	2003	2004	2005	2006[p]
INDUSTRIAL MINERALS--Continued						
Stone, sand and gravel:						
Basalt	thousand cubic meters	300	300	243 [r, 3]	249 [r, 3]	250
Dolomite		3,000	3,000	949 [r, 3]	1,371 [r, 3]	1,400
Granite, dimension stone	cubic meters	40,000	40,000	22,155 [r, 3]	15,083 [r, 3]	15,000
Gravel	thousand cubic meters	11,000	11,000	13,229 [r, 3]	16,152 [r, 3]	16,000
Limestone and similar material	do.	25,000	25,000	25,000	25,000	25,000
Marble (includes alabaster) blocks	cubic meters	140,000	140,000	400,630 [r, 3]	400,771 [r, 3]	400,000
Sand:						
Industrial sand (glass sand)		600	640 [3]	650	650	650
Construction sand		21,000	21,000	21,000	21,000	21,000
Sandstone	thousand cubic meters	10	10	60 [r, 3]	1,125 [r, 3]	1,100
Sulfur:						
Elemental, byproduct	metric tons	4,500	4,500	4,500	4,500	4,500
Sulfuric acid, S content		220	220	220	220	200
Talc, soapstone, pyrophyllite	metric tons	45,529 [3]	40,000	54,145 [r, 3]	38,780 [r, 3]	40,000
Vermiculite	do.	12,000	12,000	12,000	12,000	12,000
MINERAL FUELS AND RELATED MATERIALS						
Coal		58	139 [3]	100	75	75
Coke		1,400	1,406 [3]	1,400	1,400	1,400
Gas, natural:						
Gross production	million cubic meters	27,700	30,969 [3]	31,000	31,000	31,000
Dry	do.	19,605 [3]	17,680 [3]	18,000	18,000	18,000
Petroleum:						
Crude, including condensate	thousand 42-gallon barrels	221,350 [3, 4]	221,219 [3, 4, 5]	216,956 [3, 4, 5]	222,000 [r]	220,000
Refinery products:						
Liquefied petroleum gas	do.	6,705 [3, 4]	6,763 [3, 4, 6]	4,662 [r, 3, 6]	13,943 [r, 3]	14,000
Gasoline and naphtha	do.	51,572 [3, 4]	53,210 [3, 4, 7]	58,772 [r, 3]	60,417 [r, 3]	60,000
Kerosene and jet fuel	do.	19,579 [3, 4]	19,335 [3, 4]	19,233 [r, 3]	20,485 [r, 3]	21,000
Distillate fuel oil	do.	57,457 [3, 4]	61,060 [3, 4]	61,000	61,000	61,000
Residual fuel oil	do.	66,687 [3, 4]	68,884 [3, 4]	69,000	69,000	69,000
Lubricants	do.	1,960 [3, 4]	1,855 [3, 4]	2,590 [r, 3]	2,576 [r, 3]	2,600
Asphalt	do.	5,484 [3, 4]	5,709 [3, 4]	5,800	5,800	5,800
Unspecified[8]	do.	2,139 [3, 4]	2,155 [3, 4]	2,200	2,200	2,200
Total	do.	211,583 [3, 4]	218,971 [3, 4]	223,257 [r, 3]	235,421 [r, 3]	235,600

[p]Preliminary. [r]Revised. -- Zero.

[1]Estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Table includes data available through January 2008. In addition to those listed, Egypt produced a number of commodities for which data were unavailable; these include gemstones, a number of metals, such as gold; lead, which was produced from recycled material; zinc; and manufactured mineral commodities, such as carbon black and glass.

[3]Reported figure.

[4]Source: Ministry of Petroleum of the Arab Republic of Egypt.

[5]Excluding condensate.

[6]Excluding product from fields.

[7]Gasoline only.

[8]Amounts needed to complete reported refinery products totals shown.

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TABLE 2
EGYPT: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum		Aluminium Co. of Egypt (Government, 80%, and private interests, 20%)	Nag Hammadi	230.
Aluminum, secondary		The Egyptian Copper Co.	Alexandria	50.
Carbon black		Alexandria Carbon Black Co. (Egyptian Holding Co. for the Chemical Industry, 49%; Inco-Bharat, 36%; Grasim Industries 15%)	do.	20.
Cement		Amirya Cement Co.	do.	2,500.
Do.		Cemex Egypt	Assiut	5,000.
Do.		Arab Swiss Engineering Co. (ASEC) (Suez Cement Co., 68.7%)	Helwan	2,800.
Do.		do.	El Minya	200.
Do.		Egyptian Cement Co. (Orascom Group, 40%; private interests, 40%; Holderbank Financiere Glaris Ltd., 20%)	70 kilometers east of Cairo	1,400.
Do.		Suez Cement Co. (Cements Français S.A., 54.2%)	Suez	3,000.
Do.		do.	Qattamiah	2,500.
Do.		do.	Tourah	2,500.
Do.		Alexandria Portland Cement Co. (Government 77%, and private interests, 23%)	El Mex	800.
Do.		National Cement Co. (Government, 77%, and private interests, 23%)	El Tabbin	4,000.
Do.		do.	Beni Suef	1,000.
Fertilizers, nitrogenous		Abu Qir Fertilizer & Chemical Industries Co. [private and public interests, 80.9%, and Egyptian General Petroleum Corp. (EGPC), 19.1%]	Abu Qir A	660 (ammonia); 760 (ammonia nitrate).
Do.		do.	Abu Qir B	300 (ammonia); 500 (urea).
Do.		do.	Abu Qir C	330 (ammonia); 600 (urea).
Do.		Société El-Nasr d'Engrais et d'Industries Chimiques (Government, 100%)	Suez	146 (ammonia); 450 (nitric acid); 365 (ammonia nitrate).
Do.		do.	Talkha	330 (ammonium nitrate); 570 (ammonia and urea).
Do.		Egyptian Chemical Industries (Government, 100%)	Kima	330 (ammonia); 600 (nitric acid); 800 (ammonium nitrate).
Iron ore		Egyptian Iron and Steel Co. (Government, 100%)	El-Gedida Mine, El Bahariya	3,000.
Iron oxide		El-Nasr Mining Co. (Holding Company for Metallurgical Companies, 100%)	Mines near Sinai and Aswan	150.
Natural gas	million cubic meters	Egyptian General Petroleum Corp. (EGPC) (Government, 100%)	Abu Madi	3,800.
Do.	do.	do.	Badreddin-3	3,000.
Do.	do.	do.	Abu Qir/Naf	1,900.
Do.	do.	do.	Ras Shukheir	1,600.
Do.	do.	Grupo Khalda (Repson Group, 50%; Apache Oil Co., 40%; Samsung Inc., 10%)	Khalda	24.
Petroleum, crude	million 42-gallon barrels	Gulf of Suez Oil Co. [Egyptian General Petroleum Corp. (EGPC), 50%, and Amoco Inc., 50%]	October, Suez Gulf	45.
Do.	do.	do.	El Morgan, Suez Gulf	27.
Do.	do.	Belayim Petroleum Co. [Egyptian General Petroleum Corp. (EGPC), 50%, and International Egyptian Oil Co., 50%]	Belayim, Suez Gulf	65.
Do.	do.	Suez Oil Company [Egyptian General Petroleum Corp. (EGPC), 50%; Deminex SA, 25%; Repsol S.A., 25%]	Ras Budran, Suez Gulf	15.

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TABLE 2--Continued
EGYPT: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petroleum, pipeline	million 42-gallon barrels	Arab Petroleum Pipeline Co. (Egypt, 50%; Saudi Arabia, 15%; Kuwait, 15%; United Arab Emirates, 15%; Qatar, 5%)	Ain al-Sokhna to Sidi Kir	875.
Petroleum, refined	do.	Cairo Petroleum Refining Co. (Government, 100%)	Mostorod	42.
Do.	do.	do.	Tanta	15.
Do.	do.	Alexandria Petroleum Co. (Government, 100%)	Alexandria	42.
Do.	do.	El-Nasr Petroleum Refining Co. (Government, 100%)	Suez	36.
Do.	do.	Ameriya Petroleum Refining Co. (Government, 100%)	Ameriya	27.
Do.	do.	Suez Petroleum Processing Co. (Government, 100%)	Suez	21.
Do.	do.	Asyut Petroleum Refining Co. (Government, 100%)	Asyut	18.
Phosphate rock		El-Nasr Mining Co. (Holding Company for Metallurgical Companies, 100%)	Mines at East Sabaiya, West Sabaiya and El Qusier	1,000.
Steel		Ezz El-Dekheila Group (EZDK) (Alexandria Iron and Steel Co., Al Ezz Flat Steel Co., and Al Ezz Steel Rebars)	Plants at Alexandria, Sadat City and Suez	4,500.
Do.		Egyptian Iron and Steel Co., Hadisolb (Government, 100%)	Helwan steel plant	1,500.

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The Mineral Industry of Equatorial Guinea

By Philip M. Mobbs

Offshore oil and natural gas production dominated Equatorial Guinea's mineral industry. Hydrocarbons accounted for more than 90% of the gross domestic product. In 2006, the country ranked seventh (based on production volume) of all African crude oil producers (BP p.l.c., 2007, p. 8).

Mineral resources were the property of the Government. In 2006, law No. 9/2006, which was the new Mining Law, replaced law No. 9/1981. Law No. 7/2003 and amendments formed the Environmental Law. Law No. 8/2006, which was the new Hydrocarbon Law, replaced law No. 7/1981 and its amendments. Contracts for hydrocarbon exploration and production were administered by the Ministerio de Minas, Industria y Energia. Existing production-sharing contracts were expected to be subject to renegotiation in order to make the existing contacts conform to the new Hydrocarbon Law. The Ministry also promoted the development of the Rio Muni enclave's mineral deposits, which included bauxite, diamond, gold, and niobium (columbium) and tantalum.

In 1999, the Governments of Angola, Cameroon, the Democratic Republic of the Congo, Equatorial Guinea, Gabon, Nigeria, the Republic of the Congo, and Sao Tome e Principe had established the Gulf of Guinea Commission. The Commission, which became active in 2006, was expected to enhance coordination between the petroleum exploration and production policies of its member states.

Production

Production of mineral fuels, such as condensate, crude oil, and natural gas, dominated the country's mineral sector. Natural gas production from the Alba Field was processed at a facility at Punta Europa on Bioko Island, where the condensate and liquefied petroleum gases (LPG) were stripped from the wet gas stream and the dry gas piped to the adjacent methanol plant. Some artisanally-produced gold and crude construction materials, such as clay, gravel, sand, and volcanic rock, also were produced.

Condensate and crude oil, which was produced from offshore fields, was exported. In 2006, the United States and China, respectively, were the leading destinations of the oil exports; other significant recipients were Canada, France, and Spain. Produced methanol was exported, as was some of the LPG.

Structure of the Mineral Industry

Compañia Nacional de Petróleos de Guinea Ecuatorial (GEPetrol), which was the national oil company, managed the state's interest in crude oil production operations and promoted other investment opportunities in the nation's petroleum sector. Sociedad Nacional de Gas de Guinea Ecuatorial (SONAGAS, G.E.) managed the Government's interest in natural gas-related projects, such as those for liquefied natural gas (LNG), LPG, and methanol. Exploration and production were governed by production-sharing contracts held by joint ventures of international oil companies and the Government companies.

Commodity Review

Mineral Fuels

Natural Gas and Petroleum.—Hess Equatorial Guinea, Inc. [a subsidiary of Hess Corp. of the United States (formerly Amerada Hess Corp.)] developed and operated the multireservoir offshore Okume oilfied complex for joint venture partners Energy Africa Equatorial Guinea Ltd. (a subsidiary of Tullow Oil plc of the United Kingdom) and GEPetrol. Two tension-leg platforms were set in water depths of 275 meters (m) and 535 m. Additional shallow water (45 m to 70 m) fixed platforms supported a central processing facility and drilling and production facilities. Production from the Okume Complex, which began in December 2006, was piped to the *Sendje Ceiba* floating production, storage, and offloading vessel, which was stationed 24 kilometers from the central processing facility.

Initial production from a 3.7-million-metric-ton-per-year (Mt/yr)-capacity LNG plant, which was under construction at Punta Europa, was expected to begin in 2007. The LNG plant's ownership, which comprised Marathon Equatorial Guinea Production Ltd. of the Cayman Islands (60%), Government-owned SONAGAS, G.E. (25%), Mitsui & Co. Ltd. of Japan (8.5%), and Marubeni Corp. of Japan (6.5%), also evaluated the construction of an additional 4.4-Mt/yr-capacity LNG train 2 at Punta Europa (Marathon Oil Corp., 2007, p. 11).

Outlook

Improved deepwater production technology, additional exploration, and the increased international demand for crude oil and natural gas has transformed the area around Equatorial Guinea into an interesting hydrocarbon prospect. The planned LNG plant and the production and export of commodities associated with natural gas, such as LPG and methanol, have provided the impetus for the development of the infrastructure necessary to capture natural gas, despite the very limited local market. As a result, the volume of natural gas that would have been flared has been significantly reduced.

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TABLE 1
EQUATORIAL GUINEA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Thousand 42-gallon barrels unless otherwise specified)

Commodity[3]		2002	2003	2004	2005	2006
Petroleum, crude and condensate		90,144 [4]	102,000	137,000	144,000	145,000
Gold	kilograms	100	100	150	200	200
Liquefied petroleum gases		700	800	875	3,000	2,800
Methanol	metric tons	719,000	825,000	913,000	1,100,000	750,000
Natural gas[5]	million cubic meters	1,050	1,220	1,390	2,300	2,000

[1]Estimated data are rounded to no more than three significant digits.
[2]Table includes data available through July 31, 2007.
[3]In addition to the commodities listed, Equatorial Guinea presumably produced a variety of crude construction materials (clay, gravel, and sand).
[4]Reported figure.
[5]Produced natural gas not used to produce methanol by Atlantic Methanol Production Co. L.L.C. or as rig or processing plant fuel was reinjected.

TABLE 2
EQUATORIAL GUINEA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(42-gallon barrels unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Gold	kilograms	Artisanal placer operations	Aconibe, Coro, and Mongomo	500
Liquefied natural gas	metric tons	Equatorial Guinea LNG Holdings Ltd. (Marathon Oil Co., 60%; Sociedad Nacional de Gas de Guinea Ecuatorial, 25%; Mitsui & Co. Ltd., 8.5%; Marubeni Corp., 6.5%)	Punta Europa	3,700,000 [1]
Liquefied petroleum gas		Alba Plant LLC (Marathon Oil Co., 52%; Noble Energy Equatorial Guinea Ltd., 28%; Sociedad Nacional de Gas de Guinea Ecuatorial,[2] 20%)	do.	6,000,000
Methanol	metric tons	Atlantic Methanol Production Co. L.L.C. (Marathon Equatorial Guinea Methanol Ltd., 45%; Samedan Methanol, 45%; Sociedad Nacional de Gas de Guinea Ecuatorial, 10%)	do.	1,100,000
Natural gas	million cubic meters	Joint venture of Marathon Oil Co., 63%; Noble Energy Equatorial Guinea Ltd., 34%, Compañia Nacional de Petróleos de Guinea Ecuatorial, 3%	Alba Field, Alba Block	2,300 [3]
Petroleum:				
Crude		Joint venture of Mobil Equatorial Guinea Inc., 71.25%; Devon O.E.I. Operating Inc., 23,75%; Compañia Nacional de Petróleos de Guinea Ecuatorial, 5%	Zafiro Field, Block B	102,000,000
Do.		Joint venture of Hess Equatorial Guinea, Inc., 80.75%; Energy Africa Equatorial Guinea Ltd., 14.25%; Compañia Nacional de Petróleos de Guinea Ecuatorial, 5%	Ceiba Field, Block G	12,500,000
Do.		do.	Okume Complex (includes the Ebano, the Elon, the Okume, and the Oveng reservoirs), Block G	7,300,000 [4]
Crude and condensate		Joint venture of Marathon Oil Co., 63%; Samedan of North Africa Inc., 34%; Compañia Nacional de Petróleos de Guinea Ecuatorial, 3%	Alba Field, Alba Block	16,800,000

[1]Under construction. Processing train 1 is expected to open in late 2007.
[2]In 2005, the Government's interest was transferred to Sociedad Nacional de Gas de Guinea Ecuatorial from Guinea Ecuatorial Oil and Gas Marketing Ltda.
[3]Much of the natural gas produced from the Alba Field was reinjected into the field pending the completion of the liquefied natural gas plant at Punta Europa.
[4]Production from the Okume Complex began in December 2006. Peak production of about 22 million barrels per year is expected in 2008.

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The Mineral Industry of Eritrea

By Harold R. Newman

The East African country of Eritrea was considered to have favorable geology for mineral resources yet was relatively unexplored by modern exploration methods. Geologically, Eritrea is largely made up of Tertiary to Recent volcanics and Neoproterozoic terranes. Marine sediments of Mesozoic to Quanternary age are exposed in the coastal area of Eritrea along the Red Sea. Several high-grade volcanic massive sulfide (VMS) discoveries were made in the past 5 years. The country has possible reserves of natural gas and petroleum. Eritrea had a crude refining capacity of 18,000 barrels per day, but the refinery located in the Red Sea Port of Assab has been shut down since 1997 owing to high operating and maintenance costs. Refined petroleum products were imported to meet domestic needs. Most energy came from biomass, such as charcoal and wood (Eritrea Embassy, London, 2006).

Production

The country produced a variety of minerals and mineral products, such as industrial minerals and construction materials, which included basalt, cement, common clay, coral, granite, gravel, gypsum, kaolin, lime, limestone, marble, pumice, quartz, salt, sand, and silica sand (table 1). Artisan miners produced small amounts of gold. The country has deposits of barite, chromium, copper, feldspar, iron ore, lead, magnesium, nickel, potash, silver, talc, and zinc that were not exploited in 2006.

Structure of the Mineral Industry

The structure of the mineral industry is listed in table 2. Most industries are small and privately owned.

Government Policies and Programs

The Government suspension of all mineral exploration activity in Eritrea was lifted in early 2005 and companies, including Nevsun Resources Ltd., Sub-Sahara Resources N.L. of Australia, Sanu Resources Ltd., and Sunridge Gold Corp. of Canada, resumed exploration activities in late 2005 and continued their activities through 2006. Starting in 2006, the Government increased the maximum possible equity interest that it may hold in a project through an option agreement to 30%. The Eritrean mining code was based on the mining code of the Northern Territory of Australia. It provides a royalty of 5% on precious metals and 3% on base metals, and a corporate tax rate of 35% (Mining Journal Online, 2006).

Commodity Review

Metals

Copper, Gold, Silver, and Zinc.—Nevsun was continuing to advance its Bisha project. Bisha is a large base-and precious-metals VMS deposit. A model for the deposit suggested felsic dominated bimodal-silicastic VMS and Noranda/Kuroko-type deposits. A comparison has been made to the Matagami VMS district in the Province of Quebec, Canada (Nevsun Resources Ltd., 2006b).

Nevsun completed the final Bisha feasibility study in October 2006. Highlights from the feasibility showed metal production (based on a 10-year open pit mine life) of 30 thousand kilograms of gold, 338 thousand metric tons of copper, and 285 thousand kilograms of silver. The operating cost was expected to be $31.64 per milled metric ton through the life of the mine (Nevsun Resources Ltd., 2006a).

Sub-Sahara held the Adi Nefas, the Debarwa, and the Medrizien exploration licenses near Asmara; these licenses composed the company's Asmara Project. In 2006, 66 diamond drill holes that encompassed more than 12,000 meters (m) were drilled on the Adi Nefas VMS deposit; the drilling defined in greater detail the known zones of mineralization. The drill program confirmed that three distinct zones existed—a gold oxide zone underlain by a supergene copper zone underlain by a primary zinc-rich zone. Sub-Sahara and its joint-venture partner Dragon Mining NL of Australia continued diamond drilling at the Zara project in northwestern Eritrea (Dragon Mining N.L., 2006).

Sanu was the leading exploration landholder in Eritrea and had exploration licenses totaling more than 2,600 square kilometers (km^2). Sanu continued exploration of its properties in western Eritrea. The company was concentrating mainly on the Hambok property, which was its most recent VMS discovery in the polymetallic belt. A total of 7,382 m in 43 diamond drill holes confirmed massive sulfide mineralization. This mineralization was intersected for more than 1,050 m of strike length and 300 m downdip and was open in all directions. Sanu considered that Hambok had the potential to be a significant copper-zinc deposit (Yahoo Finance, 2006).

Sunridge's Asmara project covers 1,100 km^2 in central Eritrea. Within the Asmara project were two copper, gold, silver, and zinc VMS deposits (Adi Nefas and Debarwa), one gold deposit (Gupo), and a large VMS deposit (Emba Derho). Drilling at Adi Nefas defined mineralization for a total of more than 450 m of strike length and down to more than 300 m from the surface. Drilling at Debarwa defined mineralization for a total of more than 1,000 m of strike length and down to about 250 m from the surface. The total estimated inferred resources at Adi Nefas and Debarwa as of January 2007 were 8.1 million metric tons (Mt) at grades of 1.91 grams per metric ton (g/t) gold, 39.51 g/t silver, 1.78% copper, and 2.46% zinc. The estimated inferred resource at the Gupo gold deposit was 1.9 Mt of ore at an average grade of 2.99 g/t gold (Sunridge Gold Corp., 2006).

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TABLE 1
ERITREA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004	2005	2006[e]
Basalt		148,424	111,677	499,349	184,027	185,000
Cement[e]		45,000	45,000	45,000	45,000	45,000
Clays:						
Common		225,504	218,539	173,412	3,700,000 r	29,000
Kaolin		250	281	101	518 r	500
Coral		49,297	70,000 e	95,131	91,348	92,000
Gold	kilograms	--	9	33	25	25
Granite		150,053	140,418	192,803	350,280	350,000
Gravel		220,928	340,125	169,254	219,837	220,000
Gypsum		504	1,284	500	212 r	225
Laterite		5,200	832	1,240	44	45
Lime		47,406	5,400	2,915	22,423	22,000
Limestone[e, 3]		2,900	2,900	2,900	2,900	3,000
Marble block	square meters	12,851	1,777,814	780,733	36,046	36,000
Pumice		212	50	439	56	60
Quartz		215	370	4,496	103	150
Salt		116,268	52,414 r	30,754 r	63,000 r	60,000
Sand	thousand metric tons	605	788	611	1,163	1,200
Silica sand		36	40 e	46	50 e	50

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised. -- Zero.
[1]Table includes data available through July 30, 2007.
[2]In addition to the commodities listed, feldspar and talc reportedly were produced, but information is inadequate to estimate output.
[3]For other than cement.

TABLE 2
ERITREA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Cement	Eritrea Cement Works	Massawa	45,000

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TABLE 3
ERITREA: MINERAL RESOURCES IN 2006

Deposit	Operating companies	Tonnage[1]	Grade[1]	Mineral content[1]
Bisha:				
Primary zinc zone	Nevsun Resources Ltd.	13.6 Mt	8.8% Zn, 1% Cu, 0.7 Au, and 57 g/t Ag	1.2 Mt Zn, 130,000 t Cu, 770 t Ag, and 10 t Au.
Supergene copper zone	do.	7.83 Mt	3.8% Cu, 0.7 g/t Au, and 30.7 g/t Ag	300,000 t Cu, 240 t Ag, and 6 t Au.
Oxide zone	do.	5.11 Mt	7.1 g/t Au and 30.4 g/t Ag	36 t Au and 155 t Ag.
Primary copper zone	do.	2.1 Mt	3.1% Zn, 0.8% Cu, 0.7 g/t Au, and 32.3 g/t Ag	66,000t Zn, 18,000 t Cu, and 68 t Ag.
Emba Dero[2]	Sub-Sahara Resources NL, 48%; Sunridge Gold Corp., 40%; Africa Wide Resources Ltd., 12%	2.59 Mt	2.36% Zn, 0.39% Cu, 0.1 g/t Au, and 4.5 g/t Ag	61,000 t Zn, 10,000 t Cu, and 12 t Ag.
Debarwa:[2, 3]				
Main and footwall zones	do.	1.65 Mt	5.1% Cu and 1.4 g/t Au	84,000 t Cu and 2 t Au.
Leached zone	do.	0.47 Mt	7.07 g/t Au	3 t Au.
Gupo Gold (Adi Nefas Doop)[2]	do.	1.9 Mt	2.99 g/t Au	6 t Au.
Adi Nefas Gossan[2]	do.	1.4 Mt	9.3% Zn, 1.4% Cu, 1.6% Pb, 4.28 g/t Au, and 160 g/t Ag	130,000 t Zn, 20,000 t Cu, 22,000 t Pb, 6 t Au, and 220 t Ag.

[1]Abbreviations used for units of measure in this table include the following: g/t--grams per metric ton; Mt--million metric tons; t--metric tons. Abbreviations used for commodities in this table include the following: Ag--silver; Au--gold; Cu--copper; Pb--lead; Zn--zinc.

[2]Sub-Sahara indicated that these resource estimates are not in compliance with the standards set by the Australasian Joint Ore Reserves Committee; readers were advised to treat these estimates with caution.

[3]Sub-Sahara Resources NL reported that additional resources at Debarwa were 1.3 Mt; grades are not available.

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THE MINERAL INDUSTRY OF ETHIOPIA

By Thomas R. Yager

In 2006, Ethiopia played a significant role in the world's production of tantalum; the country's share of global tantalum mine production amounted to 5%. Other domestically significant mining and mineral processing operations included cement, crushed stone, dimension stone, and gold (Magyar, 2007). Ethiopia was not a globally significant consumer of minerals.

Minerals in the National Economy

In fiscal year 2005-06, the manufacturing sector accounted for 5.3% of the gross domestic product, and mining and quarrying, 0.5%. The value of output in the mining sector increased by 8.3% in fiscal year 2005-06. From fiscal year 2000-01 to fiscal year 2005-06, the value of output in the construction sector increased by an average of 9.9% per year. Gold exports were $64.7 million, or 6.5% of total exports (International Monetary Fund, 2007, p. 5, 26).

Production

In fiscal year 2005-06, dolomite production increased by 496%; sand, 160%; salt, 150%; scoria, 96%; basalt, 58%; and columbite-tantalite, by 18% (table 1). Cement output increased by nearly 90% from fiscal year 2001-02 to fiscal year 2005-06. Higher construction material output may be attributable to growth in the construction sector (Gebre Egziabher Mekonen, Mineral Operations Department Head, Ethiopia Ministry of Mines and Energy, written commun., August 15, 2006).

Structure of the Mineral Industry

Mugher Cement Enterprise and Messebo Building Materials Production Share Company were state-owned; the Dire Dawa cement plant was privatized in 2005 (Nigatu, Zenebe, and Tadessse, 2006). Gold, marble, and platinum, and most salt mining companies were privately owned; niobium (columbium), soda ash, and tantalum mining companies were state-owned (table 2).

Commodity Review

Metals

Gold.—Midroc Gold Mine plc (a subsidiary of Midroc Ethiopia Group) produced most of the county's gold output at the Lega Dembi Mine in southern Ethiopia. In March 2006, the Government announced that it had signed an 11-year agreement with Western Wellega Gold Exploration plc (an Ethiopian- and Russian-owned company) to mine gold at Dengi in Oromia State. The company planned to produce nearly 1,500 kilograms per year of gold from placer deposits, starting in February 2007 (Bekele, 2006a; Ethiopia Ministry of Mines and Energy, 2006a).

Iron and Steel.—Sheba Steel Mills plc planned to increase its capacity to 20,000 metric tons per year (t/yr) from 10,000 t/yr by January 2007. Wallia Steel Factory planned to start production at its new plant with a capacity of 36,000 t/yr in November 2006. Housing construction projects were expected to consume 505,000 metric tons of rebar over a 4-year period; the Government banned scrap exports in early October 2006 to prevent shortages (Addis Fortune, 2006).

Industrial Minerals

Cement.—Ethiopia's cement plants were producing at their full capacity of about 1.7 million metric tons per year (Mt/yr) in 2006. In spite of the recent increases in production, Ethiopia experienced shortages of cement; demand was estimated to be 2.4 Mt/yr. The dam and irrigation canals for the Tendaho Sugar Plantation project consumed more than 150,000 t/yr of cement. Other projects that contributed to shortages included the construction of residential housing, 3 hydroelectric dams, and 5,561 kilometers (km) of new roads (Nigatu, Zenebe, and Tadessse, 2006; Zenebe, 2006).

Mugher Cement Enterprise planned to start an expansion of its capacity to 2.3 Mt/yr from 900,000 t/yr in late December 2006; the project was expected to be completed in September 2008. National Cement SC planned to increase capacity at the Dire Dawa plant to about 180,000 t/yr from 72,000 t/yr. Falath Petroleum Company of Saudi Arabia planned to complete a new cement plant at Melka Jedu with a capacity of about 660,000 t/yr in 2009. Midroc Ethiopia Group and Star Business Group planned to build new plants in the Dejen area with capacities of 110,000 t/yr and 73,000 t/yr, respectively. The Addis Ababa city government was considering the reopening of the Addis Ababa Cement Factory, which had a capacity of 120,000 t/yr (Building Bulletin, 2006; Nigatu, 2006; Nigatu, Zenebe, and Tadessse, 2006; Zenebe, 2006).

Gemstones.—In September 2006, Romso Minerals plc (an Ethiopian- and Swiss-owned company) signed an agreement with the Government to mine peridot and olivine at Romso Kebele in Oromia State. The value of production was expected to be $17.3 million over the course of the 10-year mining license (Ethiopian Herald, 2006).

Salt.—In 2006, Ethiopia was producing salt at a rate of 218,000 t/yr; domestic consumption amounted to nearly 400,000 t/yr. Salt was imported from Djibouti. Afar Salt Production Share Company had a capacity of 50,000 t/yr in early 2006; the company planned to increase its capacity to 250,000 t/yr and to import salt iodization machinery. The Government mandated that all table salt be iodized by November 2006; only 4.3% of the population consumed iodized salt in 2003 (Ethiopian Reporter, 2006a; Tadesse, 2006).

Mineral Fuels

Natural Gas.—In February 2006, the Government cancelled the license held by Si Tech International of Jordan

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for development of the Calub and Hilala gasfields because the company failed to start work on the project. In August, the Government awarded the license to Petronas Carigali Overseas Sdn. Bhd. of Malaysia. Petronas planned to build a gas-to-liquids plant at Calub and a petroleum products pipeline to Djibouti at an estimated cost of $1.9 billion (Bekele, 2006b; Xinhua News Agency, 2006).

Petroleum.—Petronas explored for crude petroleum at Block G in the Gambella Basin. In 2006, the Government signed production sharing agreements with Afar Exploration LLC of the United States for areas in Afar National Regional State, and Lundin Petroleum AB of Sweden for the onshore Blocks 2 and 6 in the Ogaden Basin. The Government also signed an exploration agreement with White Nile Ltd. of the United Kingdom for an onshore block in Gambella Basin (Bekele, 2006b; Ethiopia Ministry of Mines and Energy, 2006b; Ethiopian Reporter, 2006b).

Outlook

The low level of mineral exploration in Ethiopia was likely to constrain production increases for niobium (columbium), gold, silver, and tantalum. Cement demand was likely to continue to increase because of Government plans to build 20,000 km of new roads, 500,000 new houses, and 5 hydroelectric dams in the next 5 years. The road construction projects were expected to consume 3 million metric tons of cement. Cement production was unlikely to increase until late 2008 because of capacity constraints. The production of other construction materials was likely to increase (Nigatu, Zenebe, and Tadessse, 2006; Zenebe, 2006).

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TABLE 1
ETHIOPIA: PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2002[e]	2003	2004	2005	2006[e]
Cement, hydraulic		900,000 [4]	1,130,066	1,315,934	1,568,624 [r]	1,700,000
Clays:[5]						
Brick[e]		150,000 [r]	100,000 [r]	106,609 [4]	120,000 [r]	120,000
Kaolin, China clay		3,534 [4]	3,088	4,251	3,726 [r]	1,641 [4]
Other clay[e]	cubic meters	26,000 [r]	28,000	30,000 [r]	33,000 [r]	33,000
Columbite-tantalite, ore and concentrate:						
Gross weight	kilograms	55,000 [4]	58,350	70,730	92,500 [r]	108,900 [4]
Nb content[e]	do.	5,500	5,800	7,100	9,300 [r]	11,000
Ta content	do.	33,000	35,000 [e]	45,000	59,000 [r]	70,000 [4]
Diatomite		500	700	2,000	400 [r]	400
Feldspar		230	208	361	445 [r]	478 [4]
Gemstones:[6]						
Amethyst	kilograms	NA	NA	1	1	43 [4]
Aquamarine	do.	NA	NA	2	2	2
Emerald	do.	NA	--	1	-- [r]	--
Garnet	do.	NA	6	11	20 [r]	20
Opal	do.	NA	187	370	496 [r]	516 [4]
Peridot	do.	NA	1	--	--	4 [4]
Quartz	do.	NA	31	469	31 [r]	31
Sapphire	do.	NA	8	1	-- [r]	--
Tourmaline	do.	NA	5	5 [e]	1 [r]	1
Gold, mine output, Au content[6]	do.	3,670 [4]	3,875	3,443	4,376 [r]	4,028 [4]
Gypsum and anhydrite, crude		22,500 [4]	48,058	51,200	34,729 [r]	35,000
Lime		4,500	3,400	3,800	3,800 [e]	3,800
Platinum, mine output, Pt content[7]	kilograms	-- [4]	--	--	--	5 [4]
Quartz		NA	115	170	99 [r]	40 [4]
Salt, rock		120,000	145,070	200,000	87,354 [r]	218,000 [4]
Silver, mine output, Au content	kilograms	900 [4]	999	1,133	886 [r]	900
Soda ash, natural		3,843 [4]	4,377	6,444	8,207 [r]	8,200
Steel:[e]						
Crude		6,000	6,000	30,000	60,000	60,000
Semimanufactured		40,000	40,000	70,000	110,000	110,000
Stone, sand and gravel:[5]						
Basalt:						
Construction stone		NA	506,100	477,100	651,700	1,029,000 [4]
Other		NA	620,000	18,700	52,900	57,700 [4]
Dolomite		NA	1,600	2,250	2,148 [r]	12,812 [4]
Granite	square meters	10,000	4,087	19,499	21,000 [r, e]	21,000
Ignimbrite	cubic meters	NA	229,013	229,277	258,829 [r]	204,516 [4]
Limestone:						
Slab/tiles	square meters	NA	6,420	3,078	3,300 [r, e]	3,300
Other	thousand metric tons	2,000	2,290	2,380	1,635 [r]	1,750
Marble:						
Slab/tiles	square meters	110,000	106,241	122,008	130,000 [r, e]	130,000
Terrazzo	do.	NA	144,045	114,446	120,000 [r, e]	120,000
Block and other		14,000	16,200	14,600	22,000 [r, e]	22,000
Pumice		210,000	218,676	270,994	255,334 [r]	255,622 [4]
Rhyolite		NA	33,700 [r]	20,700 [r]	22,000 [r, e]	22,000
Sand[e]	thousand metric tons	840 [r]	660 [r]	490 [r]	312 [r, 4]	810 [4]
Sandstone	do.	NA	318	1,221	1,300 [r, e]	1,300
Scoria[e]		120,000 [r]	100,000 [r]	85,000 [r]	68,351 [r, 4]	133,706 [4]
Silica sand		6,000	5,400	4,550	4,900 [r, e]	4,900

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised. NA Not Available. -- Zero.

[1]Includes data available through June 20, 2007.

[2]Data are for the Ethiopian calendar year ending July 7 of the year listed, except for platinum and steel.

[3]In addition to the commodities listed, some lignite, sulfuric acid, and talc reportedly were produced, but information is inadequate to estimate output.

[4]Reported figure.

[5]When reported as volume or pieces, conversions to metric tons are estimated.

[6]Does not include smuggled artisanal production.

[7]Yubdo Mine only. Platinum was also reportedly contained in gold ingots from the Lega Dembi Mine, but information is inadequate to estimate output.

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TABLE 2
ETHIOPIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity
Caustic soda		Abiyata Soda Ash Enterprise (Government-owned)	Plant at Ziway	10,000.
Cement		Mugher Cement Enterprise (Government-owned)	Plant at Mugher	900,000.
Do.		Messebo Building Materials Production Share Company (Government-owned)	Plant at Mekele	700,000.
Do.		Mugher Cement Enterprise	Plant at Addis Ababa[1]	120,000.
Do.		National Cement SC	Plant at Dire Dawa	72,000.
Crushed stone		CGC Overseas Construction Ethiopia	Plant at Addis Ababa	930,000.[e]
Glass		Addis Ababa Bottle and Glass Share Company	do.	8,000.
Gold		Midroc Gold Mine plc (subsidiary of Midroc Ethiopia Group)	Mine at Lega Dembi	1,500,000 ore processing.
Do.	kilograms	do.	do.	4,300 gold.
Kaolin		Ethiopian Mineral Resources Development Enterprise (Government-owned)	Mine at Bamba Wuha	15,000.
Marble		Ethiopian Marble Industries	Mines at Harar and various sites in western Ethiopia	NA.
Do.		National Mining Corp. (subsidiary of Midroc Ethiopia Ltd.)	Mine at Boka	NA.
Do.	square meters	do.	Plant at Awash	500,000.
Do.		Saba Stones	Mine in Tigre Province	NA.
Niobium (columbium) and tantalum	kilograms	Ethiopian Mineral Development Share Company (Government-owned)	Kenticha Mine near Borena	112,000 tantalum;[e] 17,000 niobium.[e]
Platinum	do.	Golden Prospect plc	Mine at Yubdo	5.[e]
Salt		Afar Salt Production Share Company (Government-owned)	Mine at Afdera Lake	50,000.
Do.		Afdera Production Share Company, Bashanafer Trading plc, Eretale Production Share Company, and Lucy Production Share Company	Mines at Afdera Lake	NA.
Soda ash		Abiyata Soda Ash Enterprise	Mine at Lake Abiyata	20,000.[e]
Steel:				
Crude		Abyssinia Integrated Steel plc	Plant at Debre Zeit	60,000.[e]
Do.		Sheba Steel Mills plc	do.	10,000.[e]
Do.		Ethiopia Steel Smelting Enterprise (Government-owned)	NA	7,000.
Semimanufactured		Abyssinia Integrated Steel plc	Plant at Debre Zeit	60,000.
Do.		Zuquala Steel Rolling Mill Enterprise (Government-owned)	do.	36,000.
Do.		Wallia Steel Factory	NA	36,000.
Do.		Sheba Steel Mills plc	Plant at Debre Zeit	10,000.
Do.		Ethiopia Steel Smelting Enterprise	NA	7,000.
Galvanized		Akaki Metal Products Factory	Plant at Akaki	NA.
Sulfuric acid		Melkasa Aluminum Sulfate and Sulfuric Acid Factory	Plant at Melkasa	NA.

[e]Estimated. NA Not available.
[1]Not operating in 2006.

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The Mineral Industry of Gabon

By Omayra Bermúdez-Lugo

Gabon's mineral industry was dominated by crude petroleum and manganese production. Other nonfuel mineral commodities produced in the country included cement, diamond, and gold. Undeveloped resources included iron ore, niobium (columbium), and phosphate rock. The Ministère des Mines, de l'Energie, du Pétrole et des Ressources Hydrauliques is responsible for the administration of the mineral sector. Gabon is a participant in the Extractive Industries Transparency Initiative.

Minerals in the National Economy

Historically, crude petroleum has accounted for more than 40% of the country's gross domestic product and about 75% of its export earnings. Crude petroleum output, however, has been on a declining trend since 1997 (Finance & Development, 2006; Extractive Industries Transparency Initiative, 2007). In 2006, Gabon ranked third among the world's leading producers of manganese (Corathers, 2007).

Production

Data on mineral production are provided in table 1.

Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities.

Commodity Review

Metals

Gold.—Canadian-based SearchGold Resources Inc. (SGR) continued to explore for gold at the Bakoudou-Magnima gold project. In 2005, the company had signed a $4.2 million joint-venture agreement with Managem S.A. (the mining division of Morocco-based Groupe Ona) to explore and develop the prospect. Search Gold reported estimated measured and indicated oxide resources at Bakoudou to be 2.1 million metric tons (Mt) at a grade of 2.45 grams per metric ton (g/t) gold, and 570,000 metric tons (t) of measured and indicated sulfide ore at a grade of 6.11 g/t gold. As of July 2006, SearchGold had conducted ground geophysics and surface-soil geochemistry analyses at the Bakoudou property and a semiregional exploration stream sampling program at the Magnima property. In December 2006, the company announced that it would begin a drilling campaign for the Bakoudou-Magnima gold project in 2007 (SearchGold Resources Inc., 2006a, b).

Iron Ore.—A Chinese consortium headed by Government-owned China National Machinery & Equipment Import & Export Corp. was granted the sole rights to develop the 500-Mt Belinga iron ore deposit at a cost of $3 billion. The project, which would be located about 500 kilometers (km) east of Libreville, would include the construction of a port, a railway, and two hydroelectric power stations. Work was expected to begin in 2007 and to be completed in 3 years. Output was to be sold to steel mills in China. Companhia Vale do Rio Doce of Brazil had been among the initial bidders on the project (China Economic Net, 2006; Mining Journal, 2006; TerraDaily, 2006).

Manganese.—Production of manganese from the Moanda Mine reached 3 Mt in 2006 compared with 2.86 Mt in 2005. The increase in production was attributed to additional production from the sinter plant, a new supervision system for the plant process, and an increase in throughput at the washing plant. Compagnie Minière de l'Ogooué S.A. (Comilog), a subsidiary of Eramet Manganese, which was one of the three main divisions of France-based Eramet S.A., operated the mine.

Comilog planned to increase production capacity at Moanda to 3.3 million metric tons per year (Mt/yr) in 2007 and to 3.5 Mt/yr by 2008. Ore grades at Moanda ranged from 44% to more than 50% Mn with the lower grade manganese containing impurities of phosphorus and silica. Manganese fines (43% Mn) produced at the main washing plant were beneficiated and upgraded to 52% Mn and then to 58.5% Mn by sintering. The 52% product, known as HM-grade manganese, was mixed with silica sand and coke and sold in its own right. About 46,000 t of HM-grade manganese was sold in 2006 compared with 26,000 t in 2005 and 83,000 t in 2003. About one-third of production was destined for ferroalloy plants owned by Eramet in China, France, Norway, and the United States; the remaining two-thirds of production was exported to other customers in China, India, and Ukraine, also for ferroalloy production. Ore was transported through the single-track Transgabonais railway, which was run by Eramet. The railway also transported timber, general cargo, and passengers, which limited possible tonnage from the Moanda Mine to 3.5 Mt/yr. All exported manganese ore was shipped via the Owendo Port near Libreville. Transit time from the Moanda Mine to Owendo fluctuated between 15 to 20 hours.

Comilog managed the Owendo Port and owned a 36.35% interest in the facility; the Government held the remaining interest through the Port Authority. Ships at Owendo Port were generally in the 40,000-t bulk-capacity range, but could have a capacity of more than 50,000 t. In 2006, 85 vessels passed through the port carrying a total of about 2.9 Mt of manganese; the Chinese Ports of Xingang and Zhanjiang were the main destinations followed by Europe and the United States (Eramet S.A., 2007, p. 12; Mining Magazine, 2007).

In May, Renova Group of Russia was granted a license to explore for gold, manganese, platinum-group metals, and uranium in the southeastern Provinces of Haut Ogooue, Ngounie, and Ogooue-Lolo. Renova Group was the parent company of Russian aluminum producer OAO SUAL Holding (Renova Group, 2006).

Industrial Minerals

Diamond.—SouthernEra Diamonds Inc. of Canada decided to withdraw its diamond operations from Gabon following negative

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bulk sampling results from its 2006 exploration program. The company, which held 100% interest in the Kango and the Sud properties, a 95% interest in the M'Bigou property, and a 60% interest in the Makongonio property, had reportedly discovered more than 41 new kimberlites and related rocks in the country in at least three new kimberlite provinces (SouthernEra Diamonds Inc., 2006, p. 29-32; 2007, p. 6).

Motapa completed a field program for its 100% owned Lebiri project in early 2006, which consisted of heavy mineral and geochemical sampling. Preliminary results suggested probable kimberlitic chromites based on several stream sediment samples and loam samples taken from three sites; two of the sites reportedly yielded geochemical signatures indicative of a likely kimberlitic source. The company planned to conduct detailed sampling, a helicopter-borne magnetic survey, and a radiometric survey in 2007 (Motapa Diamonds Inc., 2006b; 2007, p. 3, 6-7).

Mineral Fuels and Related Materials

Petroleum.—According to BP p.l.c. world energy statistics, Gabon ranked seventh among sub-Saharan Africa's leading petroleum producers in 2006. The country's petroleum reserves were estimated to be 2 billion barrels and to account for about 2% of sub-Saharan Africa's total inferred reserve base (reported as proven petroleum reserves). Petroleum production in Gabon, however, has been on a declining trend since 1997 mostly owing to maturing oilfields. Total petroleum produced in 2006 was about 232,000 barrels per day (bbl/d) compared with about 365,000 bbl/d in 1996 (BP p.l.c., 2007).

At least nine petroleum companies were engaged in petroleum exploration and (or) production in the country, including Canadian companies Addax Petroleum Corp. and Canadian Natural Resources Ltd., Indian Oil Corp. of India, Maurel & Prom and Total S.A. of France, Energem Resources Inc. of South Africa, Philippines-based PetroEnergy Resources Corp., London-based Tullow Oil plc, and VAALCO Energy Inc. of the United States.

Uranium.—Motapa held 100% interest in an exclusive exploration license to explore for uranium in east-central Gabon in an area located about 100 km northwest of the Mounana uranium district; uranium deposits in this area had reportedly produced more than 35,000 t of uranium metal between 1961 and 1997. In March 2006, Motapa signed a letter of agreement with Cameco Corporation and Pitchstone Exploration Ltd. under which the two companies could earn up to a 56% interest in the project by funding forward work at Mounana (Motapa Diamonds Inc., 2006a).

Outlook

At the current extraction rate of about 85 million barrels per year, Gabon's total inferred petroleum reserve base of about 2 billion barrels is likely to be depleted by 2031. Commercially successful new discoveries by petroleum companies operating in the country, however, could reverse this trend. Diminishing oil reserves and decreases in crude petroleum output may force the Government to shift its priorities from the fuel sector to the nonfuel mineral sector. New developments, such as ongoing expansions at the Moanda manganese mine and the development of the Belinga iron ore deposit by Chinese interests, may help counterbalance some of the projected loss in revenue from the petroleum sector. Gabon's weak infrastructure is likely to be revamped in the next 5 to 6 years if proposed infrastructure developments, which would include the construction of roads, railroads, a deepwater port and hydroelectric plants, come to fruition as part of the planned investments in the mineral industry.

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TABLE 1
GABON: PRODUCTION OF MINERAL COMMODITIES[1]

Commodity[2]		2002	2003	2004[e]	2005[e]	2006[e]
Cement, hydraulic[3]	metric tons	257,000[4]	260,000[e]	260,000	260,000	260,000
Clinker[e]	do.	350,000	350,000	350,000	350,000	350,000
Diamond, gem and industrial[e]	carats	500	500	500	500	500
Gold, mine output, Au content[e, 5]	kilograms	70	70	300	300	300
Manganese:						
Metallurgical-grade ore, gross weight (50% to 53% Mn)	thousand metric tons	1,816	1,950[e]	2,400	2,800	2,900
Pellets, battery- and chemical-grade, gross weight (82% to 85% MnO_2)	do.	40	50[e]	60	59	100
Total	do.	1,856	2,000[e]	2,460[4]	2,859[4]	3,000[4]
Natural gas, gross[e]	million cubic meters	80	79	80	80	80
Petroleum:						
Crude	thousand 42-gallon barrels	91,980	87,965	87,235[4]	85,469[4]	84,738[4]
Refinery products	do.	6,500	6,500[e]	6,300	6,000	6,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. -- Zero.
[1]Table includes data available through November 2, 2007.
[2]In addition to the commodities listed, a variety of crude construction materials (clays, sand and gravel, and stone) is also produced, but output is not reported, and available information is inadequate to make reliable estimates of output.
[3]Includes cement produced from imported clinker.
[4]Reported figure.
[5]Gold production figures do not include production smuggled out of the country, which was estimated to exceed 400 kilograms per year.

TABLE 2
GABON: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies and and major equity owners	Location of main facilities	Annual capacity
Cement		Ciments du Gabon (Heidelberg Cement Group, through Scancem International ANS)	Cement-grinding plant at Owendo, south of Libreville	240,000
Do.		do.	Cement-grinding plant at Franceville, southeastern Gabon	170,000
Clinker		do.	Clinker plant at N'Toum, 40 kilometers east of Libreville	300,000
Gold	kilograms	Artisanal miners	Eteke region	300 to 700
Manganese		Compagnie Minière de l'Ogooué S.A. (Comilog) (Eramet S.A., 57%; Government, 27%; other, 16%)	Open pit mine at Moanda	3,000,000
Petroleum:				
Crude	thousand 42-gallon barrels	Total Gabon S.A., 58%; Government, 25%; other, 17%	Anguille, Avocette, Baudroie, Gonelle, Torpille, and Rabi Kounga oilfields	NA
Do.	do.	PanAfrican Energy Corporation Ltd., 33.90%; Vaalco Gabon Inc., 30.35%; Sasol Petroleum, 30%; Sojitz Corp., 3.225%; Petro Energy Resources Corp., 2.525%	Etame Marine Block, offshore: Avouma oilfield (under development)	2,400
Do.	do.	do.	Ebouri oilfield (exploration stage)	--
Do.	do.	do.	Etame oilfield	6,570
Do.	do.	Marathon Oil Corp., 56%; Tullow Oil plc, 25%; Devon Energy Corp. (% ownership unknown)	Tchatamba Marin oilfield	NA
Do.	do.	do.	Tchatamba West oilfield	NA
Do.	do.	do.	Tchatamba South oilfield	NA
Do.	do.	PanOcean Energy Corp., operator, 92.5%	Obangue oilfield	1,800
Do.	do.	do.	Tsiengui oilfield	1,800
Do.	do.	PanOcean Energy Corp., operator, 90%	Remboue oilfield	NA
Do.	do.	PanOcean Energy Corp., 31.4%	Etame Marin oilfield	2,300
Refinery products	do.	Total Gabon S.A., 58%; Government, 25%; other, 17%	Port Gentil	8,800

NA Not available. -- Zero.

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THE MINERAL INDUSTRIES OF THE GAMBIA, GUINEA-BISSAU, AND SENEGAL

By Omayra Bermúdez-Lugo

THE GAMBIA

Mining in The Gambia, which was limited to the production of clay, laterite, silica sand, and zircon, did not play a significant role in the country's economy. The Department of State for Trade, Industry, and Employment was the Government entity responsible for the administration of the mining sector. A new mineral and mining law proposed in 2001 was still under consideration for approval by the Government in 2006.

Production

Data on mineral production are provided in table 1.

Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities.

Commodity Review

Metals

Titanium Minerals and Zircon.—In January 2006, Carnegie Corporation Ltd. (CCL) of Australia (50%), through its 45% owned subsidiary Carnegie Minerals plc, in joint venture with Astron Ltd. of China (50%) received final Government approval to begin mining at the Batukunku, the Kartung, and the Sanyang mineral sands deposits in Brufut. The mining license constituted the first mining license granted by the Government in more than 50 years. Three of the four dredges to be used to mine these deposits were commissioned in 2006; the remaining dredge was scheduled to be commissioned in 2007. On September 28, 2006, the company announced that it had started mining the Sanyang deposit and that it had shipped 1,320 metric tons (t) of concentrates to China (Carnegie Minerals plc, 2006).

The spiral concentration units used in conjunction with the dredges to mine the Batukunku, the Kartung, and the Sanyang mineral sands were expected to produce a combined heavy mineral concentrate that contains both the nonmagnetic minerals rutile and zircon and the magnetic mineral ilmenite. The combined concentrate was to be sold and shipped to Yingkou Astron Chemical Co. Ltd. of China, which was a subsidiary of joint-venture partner Astron. CCL expected to produce about 80,000 metric tons per year (t/yr) of heavy mineral concentrate, or about 15,000 t/yr of nonmagnetic concentrate, by 2007. The company's target thereafter would be 20,000 t/yr of nonmagnetic concentrate (rutile and zircon). In April 2006, CCL announced that Astron had signed an offtake agreement for the entire rutile and zircon production. The offtake agreement was for the entire economic life of the license. A magnetic separation plant was to be built to enable the separation of the magnetic and nonmagnetic minerals before shipment to China. The washed sand byproduct was to be sold to the local construction industry. Carnegie believed that the mineral sands deposits in The Gambia extend into Senegal and therefore was pursuing exploration in Senegal throughout the year (Carnegie Corporation Ltd., 2006a, b; 2007, p. 2-7; Industrial Minerals, 2006).

Total measured, indicated, and inferred resources at the Batukunku, the Kartung, and the Sanyang deposits were estimated to be 18.8 million metric tons (Mt) containing about 1 Mt of heavy minerals at a cutoff grade of 1%. The heavy-mineral assemblage for these deposits was estimated to be about 71% ilmenite, 15% zircon, and 3% rutile (Carnegie Corporation Ltd., 2005, p. 7-9).

Mineral Fuels

Petroleum.—The Gambia did not produce petroleum and depended upon imports to meet its domestic energy requirements. Liquefied petroleum gas was imported from Senegal. In September 2006, Buried Hill Energy (Cyprus) Public Company Ltd., through its wholly owned subsidiary Buried Hill Gambia B.V., signed an exploration, development, and production agreement with the Government for offshore Blocks A1-Alhamdulilah and A4. Exploration drilling was to begin in 2008 (Buried Hill Energy (Cyprus) Public Company Ltd., 2006; Rigzone.com, 2006).

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GUINEA-BISSAU

Mining in Guinea-Bissau was limited to small-scale production of construction materials, such as clays, granite,

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limestone, and sand and gravel. The country's prospective mineral resources included bauxite, diamond, gold, heavy minerals, petroleum, and phosphate rock.

Commodity Review

Industrial Minerals

Phosphate Rock.—Red Back Mining Inc. reported that in July 2006, the Government of Guinea-Bissau intended to expropriate the company's rights to mine the Farim phosphate deposit, which is located about 100 kilometers (km) northeast of Bissau. The company had completed a technical and market evaluation of the Farim phosphate deposit in 2003 and concluded that the project had advanced to a stage where the level of developmental, operational, and marketing expertise required to move it forward was beyond that of Red Back Mining. Since then, the company had attempted to either locate a suitable partner to develop the deposit or sell the deposit. The company was unsuccessful in both endeavors and kept the project on care and maintenance status in 2005. In 2006, in light of the new developments, the company announced the writeoff of all expenditures related to the Farim deposit during the year and continued to keep the property on care and maintenance status. Red Back Mining estimated the phosphate rock resource at Farim to be more than 166 Mt at a grade of 29% P_2O_5 (Red Back Mining Inc., 2006a, p. 6; 2006b, p. 3).

Mineral Fuels

Petroleum.—Guinea-Bissau did not produce petroleum and depended upon imports to meet its domestic energy requirements. At least one company, Premier Oil plc of the United Kingdom, was conducting petroleum exploration during the year. Premier completed the processing of the three-dimensional (3-D) seismic survey data that it had acquired in 2005 for the Eirozes prospect and the reprocessing of the existing 3-D data for the Espinafre prospect and planned to drill two wells in 2007. The company also held exploration licenses for offshore Blocks 2, 4a, 5a, 7b, and 7c (Premier Oil plc, 2007, p. 15).

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SENEGAL

Phosphate rock production, which was processed and converted to phosphoric acid, dominated Senegal's mining sector. Phosphoric acid production accounted for about 3% of the gross domestic product and 10% of exports in 2005. Other mineral commodities produced in the country were basalt, cement, clays, gold, laterite, limestone, natural gas, petroleum, salt, and sand (International Monetary Fund, 2007, p. 9).

Production

Production of phosphoric acid and phosphate rock decreased by 64% and 60%, respectively, while production of attapulgite, crude petroleum, and salt increased modestly. Data on mineral production are provided in table 1.

Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities.

Commodity Review

Metals

Gold.—AXMIN Inc. (AXMIN), IAMGOLD Corp. (IAMGOLD), and Oromin Explorations Ltd. (Oromin) of Canada; Mineral Deposits Ltd. (MDL) of Australia; and Randgold Resources Ltd. (Randgold) of the United Kingdom continued to explore for gold in 2006. AXMIN held exploration permits for the Heremakono, the Sabodala NW, and the Sonkounkou properties, which lie within the Kedougou-Kenieba inlier of the Birimian gold belt that borders Mali. IAMGOLD, which had been exploring in Senegal since the early 1990s, reported that it had spent about $1.6 million in 2006 to compile, review, and reinterpret historic data from its Bambadji and Daorala Boto gold project in the southeastern part of the country. The company also conducted a trenching and geochemical sampling program of six zones in the Bambadji corridor and the Boto zone and completed a large-scale geophysical survey for the areas (IAMGOLD Corp., 2007, p. 13, 49).

Oromin continued its $8 million exploration program. During 2006, a total of 70 core holes and 10 reverse circulation holes were completed, primarily at the Golouma West, the Masato, the Niakafiri, and the South gold zones. As of yearend, the company was awaiting additional reverse circulation rigs to be used at its Sabodala concession (Oromin Explorations Ltd., 2006).

MDL held an exploration permit for the Niakafiri and the Sabodala gold deposits in southeastern Senegal. As of June 30, 2006, MDL had invested $20.9 million in gold exploration in the country. An updated mineral resource estimate for the Sabodala gold deposit was completed by RSG Global Consulting Pty Ltd. of Australia in May 2006 and yielded a resource estimate of about 20 Mt at an average grade of 2.7 grams per metric ton (g/t) gold. A total of five drill rigs were operating at the company's properties throughout the year. In August 2006, the company began negotiations with the Government to obtain a mine lease for the Sabodala gold deposit. Preliminary resource estimates at the Niakafiri gold deposit were reported to be 9,900 kilograms of gold (reported as 317,000 troy ounces) (Mineral Deposits Ltd., 2007, p. 10-14).

Randgold held four exclusive exploration permits in Senegal for an area that covers 1,326 square kilometers (km^2) within the Sabodala gold belt. In 2006, the company began a 10,000-meter

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rotary air blast drilling program to test 12 targets (Randgold Resources Ltd., 2007, p. 37).

Iron and Steel.—Société des Mines de Fer du Senegal Oriental (MIFERSO) was the Government-owned company in charge of the development of the Faleme iron ore deposit, which is located in southeastern Senegal. Kumba Iron Ore (KIO) (formerly Kumba Resources Ltd.; name was changed in November 2006) of South Africa had signed an agreement with MIFERSO in July 2004 to explore the resources at Faleme. Upon completion of a prefeasibility study in November 2005, the company had planned to exercise its option to acquire an 80% interest in the Faleme project and subsequently to begin a bankable feasibility study for the integrated development of a 12 million-metric-ton-per-year (Mt/yr) mine and related infrastructure project. The Government, however, did not acknowledge the company's rights to the project and reportedly had signed a memorandum of understanding to allocate an option for the deposit to Arcelor Mittal (formerly Mittal Steel Company NV; name was changed in June 2006 after the merger with Arcelor S.A.). In 2006, KIO decided to terminate all work related to the Faleme deposit and announced that it would pursue the necessary legal actions to preserve its contractual rights to the deposit. As of yearend, the issue remained unresolved (Metal Bulletin, 2006; Kumba Iron Ore, 2007, p. 32).

Titanium Minerals and Zircon.—MDL was pursuing the development of the Grand Côte Zircon Project (GCZP), which is a mineral sands deposit located on the northern coast of Senegal about 100 km north of Dakar. As of June 30, 2006, the company had spent $12.1 million on the project, had completed an environmental impact study, and was in negotiations with the Government for the issuing of a mining lease. MDL planned to produce about 85,000 t/yr of zircon beginning in the first half of 2009. Inferred resources at GCZP were reported to be 801 Mt of ore at a grade of 2.6% heavy minerals, of which about 70% was ilmenite and 11% zircon (Mineral Deposits Ltd., 2006, p. 3, 5-6, 8-10, 18-20).

In December 2006, Carnegie Minerals plc, a subsidiary of CCL, announced that it had completed infill drilling at the Niafarang prospect. The company held an exclusive exploration license to explore for mineral sands at Niafarang in southern Senegal near the border with The Gambia. Drilling samples were shipped to independent Australian laboratories (not specified) and assaying results were expected to be available by the first quarter of 2007 (Carnegie Minerals plc, 2006).

Industrial Minerals

Phosphate Rock.—Industries Chimiques du Sénégal (ICS) was Senegal's phosphate rock mining and processing company. The Government of India, through Indian Farmers Fertilizer Cooperative Ltd. (IFFCO), and Southern Petrochemicals Industries Corporation Ltd. (SPIC) were equity partners in ICS (table 2). Phosphate ore was mined from the Keur Mor Fall and the Tobene deposits within the Taiba Mine. Part of the marketable phosphate rock was sent to ICS's phosphoric acid plants in Darou Khoudoss, and the remaining was sent to Dakar Port for export. The facilities at Darou consisted of two adjacent phosphoric acid production plants that had a combined production capacity of 660,000 t/yr of P_2O_5. Most of the phosphoric acid produced was exported to India. Owing to financial difficulties, ICS temporarily interrupted operations during 2006, which resulted in a 64% decline in phosphoric acid production and approximately 60% decline in phosphate rock production. The Government was considering reducing its stake in ICS from its current 46.38% to about 10% (table 1; Industries Chimiques du Sénégal, 2006; International Monetary Fund, 2007, p. 9).

In August 2006, the U.S. Trade and Development Agency granted about $300,000 to the Ministry of Energy and Mines to fund an investment analysis of the cost and viability of mining and transporting phosphate rock from the Matam phosphate rock deposit in northern Senegal (U.S. Trade and Development Agency, 2006).

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TABLE 1
THE GAMBIA AND SENEGAL: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Country and commodity		2002	2003	2004[e]	2005[e]	2006[e]
THE GAMBIA[2]						
Clay[3]	metric tons	11,814 [4]	12,375 [4]	13,655 [4,5]	13,700	13,700
Laterite[3]		410	227 [4]	245 [4,5]	250	250
Silica sand[3]		1,508 [4]	1,534 [4]	1,389 [4,5]	1,390	1,390
Zircon/rutile concentrate	metric tons	--	13,000 [4,6]	-- [4,5]	--	410 [5,6]
SENEGAL[7]						
Basalt[3]		116	363 [8]	360	360	360
Cement, hydraulic		1,653	1,694	2,391 [r,5]	2,623 [r,5]	2,884 [5]
Clay[3]		19	21 [8]	20	20	20
Clays, fuller's earth (attapulgite)		138	195	200	127 [r,5]	140 [5]
Gold[e,9]	kilograms	600 [5]	600 [5,8]	600	600	600
Laterites[3]		112	304 [8]	300	300	300
Limestone[3]		1,461	1,588 [8]	1,600	1,600	1,600
Natural gas[e]	thousand cubic meters	3,368 [5]	12,638 [5,8]	12,600	12,600	12,600
Petroleum:[10]						
Crude oil	thousand 42-gallon barrels	726 [r,5]	290 [r,5]	202 [r,5]	374 [r,5]	388 [r,5]
Refinery products		854 [r,5]	1,091 [r,5]	1,106 [r,5]	870 [r,5]	313 [5]
Phosphate rock and related products:[11]						
Calcium phosphate-based fertilizers[12]		201	251	210 [5]	186 [r,5]	33 [5]
Crude rock:						
Aluminum phosphate		4	4 [8]	4	4	4
Calcium phosphate[12]		1,547	1,499 [r,5]	1,576 [5]	1,451 [5]	584 [5]
Phosphoric acid, P_2O_5 content[12]		638 [r,5]	511	570 [r,5]	504	180 [5]
Salt		172	235	168 [r,5]	134 [r,5]	199 [5]
Sand[3]		860	2,168 [8]	2,170	2,170	2,170

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised. -- Zero.

[1]Table includes data available through October 2007.

[2]In addition to the commodities listed, The Gambia also produced a variety of construction materials (laterite, sand, and shell), but information is inadequate to make reliable estimates of output.

[3]Values converted from cubic meters to metric tons. Specific gravity, in grams per cubic meter--basalt, 2.8; clay, 2.55; laterites, 2.55; limestone, 2.6; and sand, 2.6.

[4]Source: Geology Department of the Republic of The Gambia.

[5]Reported figure.

[6]From sales.

[7]In addition to the commodities listed, Senegal also produced sand and gravel, and stone for local construction purposes, but information is inadequate to make reliable estimates of output. The major source of information for the Senegal 2006 statistics is Agence National de la Statistique et de la Démographie.

[8]Source: Direction des Mines et de la Géologie, Republic of Senegal.

[9]Government estimate of unreported production of artisanal gold.

[10]Crude petroleum values have been converted from metric tons to 42-gallon barrels using a conversion factor of 7.4 barrels of crude petroleum per metric ton.

[11]Industries Chimiques du Sénégal was the main producer of phosphate rock in Senegal. Phosphate rock production excludes about 200,000 metric tons per year, which is estimated to be produced from other Senegalese sources.

[12]Source: Industries Chimiques du Sénégal.

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TABLE 2
THE GAMBIA AND SENEGAL: STRUCTURE OF THE MINERAL INDUSTRIES IN 2006

(Thousand metric tons)

Country and commodity	Major operating companies and major equity owners	Location of mine facilities	Annual capacity
THE GAMBIA			
Zircon/rutile concentrate[1]	Carnegie Minerals plc and Astron Ltd.	Sanyang district	20.
SENEGAL			
Attapulgite	Senegal Mines (Government, 49%, and private, 51%)	240 kilometers south of Dakar	100.
Do.	Société Senegalaise de Phosphates de Thies SA (private, 100%)	Lam Lam	NA.
Cement	Les Ciments du Sahel S.A. (private, 100%);	Kirene plant	600.
Do.	Société Ouest Africaine des Ciments (private, 100%)	Rufisque plant	1,600.
Phosphate rock, calcium	Industries Chimiques du Sénégal Group (Government, 46.38%, and Indian Farmers Fertilizer Cooperative Ltd. and Southern Petrochemicals Industries Corporation Ltd., collectively, 20.31%)	Taiba Mine	2,000.
Do.	Société Senegalaise de Phosphates de Thies SA (private, 100%)	Lam Lam, Sebikhotane, and Allou-Kagne	NA.
Phosphoric acid	Industries Chimiques du Sénégal Group (Government, 46.38%, and Indian Farmers Fertilizer Cooperative Ltd. and Southern Petrochemicals Industries Corporation Ltd., collectively, 20.31%)	Darou I plant, Darou Khoudoss	330 P_2O_5.

NA Not available.
[1]Mine under development.

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THE MINERAL INDUSTRY OF GHANA

By Omayra Bermúdez-Lugo

Ghana's economy continued to depend largely on exports of cocoa and gold. Despite shortages in electricity supply throughout the year, industrial activities grew by 7.3% in 2006 mostly owing to the production of gold (Organisation for Economic Co-operation and Development, 2007, p. 286, 291). Other mineral commodities produced in the country were aluminum, bauxite, diamond, manganese, natural gas, petroleum, salt, and silver.

Minerals in the National Economy

The contribution of Ghana's mining sector to the country's gross domestic product increased from 1.3% in 1991 to an average of about 5% in recent years. Export earnings from minerals averaged 35%, and the sector was one of the largest contributors to Government revenues through the payment of mineral royalties, employee income taxes, and corporate taxes. In 2005, gold production accounted for about 95% of total mining export proceeds (Ghana Chamber of Mines, 2006, p. 6-12).

Government Policies and Programs

The Ministry of Mines and Energy oversaw all aspects of Ghana's mineral sector and was responsible for granting mining and exploration licenses. Ghana National Petroleum Corp. (GNPC) was the Government entity responsible for petroleum exploration and production. The Precious Minerals Marketing Corp. (PMMC) was the Government entity responsible for promoting the development of small-scale gold and diamond mining in Ghana and for purchasing the output of such mining, either directly or through licensed buyers.

To help support the mineral industry, the Government planned to inject $470 million into electricity generation projects during the next 3 years. About 60% of Ghana's electricity was supplied by hydroelectric plants. The lack of new power-generating capacity and low rainfall in recent years had lowered water levels at the country's main hydroelectric dam and caused electricity shortages (Mining Journal, 2006a, b).

Production

In 2006, bauxite production increased by 38.7% to 842,000 metric tons (t) compared with 607,000 t in 2005. Diamond and silver production decreased by 4% and 12% to 973,000 carats and 3,142 kilograms, respectively. Gold production decreased to 66,205 kilograms (kg) compared with 66,852 in 2005. Data on mineral production are provided in table 1.

Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities.

Mineral Trade

Ghana's exports to the United States were valued at about $192.1 million in 2006 compared with about $158.4 million in 2005 and $145.4 million in 2004. Of these exports, petroleum products accounted for $49 million; gem-quality diamond $1.3 million; and gold, about $2.2 million. Imports from the United States were valued at about $290 million in 2006 compared with about $338 million in 2005 and $310 million in 2004. These included nearly $32 million for excavating machinery; $3.5 million for drilling and oilfield equipment; $2.6 million in specialized mining equipment; and $852,000 for petroleum products (U.S. Census Bureau, 2007a, b).

Commodity Review

Metals

Aluminum and Bauxite and Alumina.—Canada-based Alcan Inc. and Alcoa Inc. of the United States were the two companies that operated in the bauxite and alumina sector. During 2006, Alcoa continued to study the possibility of developing an integrated aluminum industry in Ghana that would include bauxite mining, alumina refining, aluminum production, and rail transportation infrastructure upgrades. Alcan, on the other hand, signed a memorandum of understanding with the Government for the creation of a joint venture to explore the feasibility of developing a bauxite mine and a 1.5- to 2.0-million-metric-ton-per-year (Mt/yr) alumina refinery in Ghana (Alcan Inc., 2007, p. 16).

Gold.—In the gold sector, Red Back Mining Inc. of Canada, [through its subsidiary Chirano Gold Mines Ltd. (CGML)] operated the Chirano gold mine; AngloGold Ashanti Ltd. of South Africa operated the Bibiani, the Iduapriem, and the Obuasi gold mines; Golden Star Resources Ltd. of Canada operated the Bogoso/Prestea, the Prestea Underground, and the Wassa gold mines; Gold Fields Ltd. of South Africa operated the Damang gold mine; and Denver-based Newmont Mining Corp. held interest in the Ahafo and the Akyem gold properties.

More-extensive coverage of the gold sector in Ghana can be found in the 2005 U.S. Geological Survey Minerals Yearbook, volume III, Area reports—International—Africa and the Middle East, which is available on the World Wide Web at http://minerals.usgs.gov/minerals/pubs/country/africa.html.

Manganese.—Of the 1.6 million metric tons (Mt) of manganese ore produced in 2006, about 52%, or 832,000 t, was shipped to Ukraine; 37%, or 584,000 t, was shipped to China; and the remaining 184,000 t was shipped to Norway. Manganese carbonate ore exported from Ghana has traditionally been used in China as raw material in the production of silico-manganese. Less than 100,000 metric tons per year (t/yr) of this ore material was used to produce electrolytic manganese metal in China, but China's demand for manganese metal was projected to increase

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to 300,000 t in 2007. China's other supplier of manganese ore was Mexico. Privat Group of Ukraine, which also used manganese ore from Ghana, imported about 832,000 t in 2006. Privat Group acquired the right to manage Ghana Manganese Co. and, as its first order of business, indicated that it intended to amend all existing manganese contracts (Tex Report, The, 2007).

Industrial Minerals

Diamond.—Diamond was recovered by artisanal miners from alluvial and in situ diamond deposits near Akwatia in the Birim Valley. The only formal commercial production came from a diamond placer mine in Akwatia, which was operated by Government-owned Ghana Consolidated Diamonds Ltd. (GCD).

At least one company, Paramount Mining Corporation Ltd., explored for diamond at two properties in Ghana in 2006. In February 2006, the company entered into a joint-venture agreement with Leo Shield Exploration Ghana Ltd. to earn interest in the Osenase project, which covers an area of 330 square kilometers (km²) located about 25 kilometers (km) south of the Akwatia Diamond Project. Field work began in March 2006. A number of pits were dug in both alluvial and hard rock deposits. A total of 83 diamonds, which together weighed more than 3.3 carats and the largest of which was 0.56 carat, were recovered from the gravel of alluvial deposits. The project area also contained gold and columbite-tantalite minerals in the alluvial material. The other property, which was known as Ochinso, covers an area of 37 km² within the Birim Diamond Field of southern Ghana. Paramount, through a farm-in arrangement with Aurion Resources Ltd. of Ghana, would be entitled to acquire 85% of the equity interest in the concession. At least 72 diamonds and 325 small gold grains from 20 small test pits were recovered from the property in 2006. The pits were situated in a number of different river systems throughout the Ochinso project area. Most of the diamonds recovered were reportedly of commercial size, ranging between 1 and 2 millimeters (mm), with an average stone size of 0.036 carat (Paramount Mining Corporation Ltd., 2007, p. 1-12).

Mineral Fuels

Petroleum.—Petroleum exploration activities have been conducted in Ghana since the late 1800s; no significant commercially sustainable deposits of petroleum or natural gas have been discovered to date, with the exception of the Saltpond oilfield, which produced a total of 294,430 barrels when it reopened in 2002 to its closing in 2004. Gas flared at Saltpond averaged 2 million cubic feet per day. The Tema Oil Refinery refined all the crude petroleum imported into the country, with the exception of consignments going to the Takoradi thermal powerplant (Energy Commission, 2006, p. 6-7).

At least two companies were exploring for petroleum in the country in 2006. These included Dallas-based Kosmos Energy LLC, which was conducting exploration offshore at West Cape Three Points Block, and Vanco Energy Co. of the United States, which explored for petroleum at the Cape Three Points Deepwater Block (CTPD) in the Tano-Ivorian Basin.

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TABLE 1

GHANA: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004[e]	2005[e]	2006[e]
Aluminum:						
Bauxite, gross weight		684	495	498 [3]	607 [r, 4]	842 [4]
Metal, smelter, primary		117	16	--	13	36 [e]
Cement, hydraulic[e, 5]		1,900	1,900	1,900	1,900	1,900
Diamond:						
Gem[e]	thousand carats	770	724	740 [r]	810 [r]	780
Industrial[e]	do.	193	180	180	200 [r]	190
Total	do.	963 [6]	904 [6]	920 [r, 7]	1,013 [r, 7]	973 [3, 7]
Gold[8]	kilograms	69,271	70,749	63,139 [3]	66,852 [3]	66,205 [3]
Manganese:						
Ore, processed		1,136	1,509	1,597 [3]	1,715 [3]	1,600 [p]
Mn content[e]		363	528	559 [3]	600	560
Natural gas[9, 10]	million cubic meters	9 [r]	9 [r]	9 [r]	-- [r]	--
Petroleum:						
Crude[9]	thousand 42-gallon barrels	400 [r]	400 [r]	400 [r]	-- [r]	--
Refinery products[e]	do.	16,000	16,000	16,000	16,000	16,000
Salt[e]		99	250	265 [3]	250 [r, 4]	250 [4]
Silver, content of exported dore	kilograms	2,129	3,379	3,329 [3]	3,571 [r, 4]	3,142 [4]
Steel, secondary, rebar[e]		75	75	75	75	75

[e]Estimated. [p]Preliminary. [r]Revised. -- Zero.

[1]Table includes data available through November 2007.

[2]In addition to the commodities listed, a variety of crude construction materials (clays, sand and gravel, and stone) are produced, as are limestone and lime for the processing of some gold ore and salt. Output of these commodities is not reported, however, and information is inadequate to make reliable estimates of output.

[3]Reported figure.

[4]Reported by Ghana Minerals Commission.

[5]All from imported clinker.

[6]Production, in thousand carats, includes that of Akwatia Mine: 2002—268, and 2003—240 (estimated). The remainder is artisanal sales to the Precious Metals Marketing Corp. Estimates of unreported artisanal production are not included.

[7]Kimberley Process Certification Scheme.

[8]Does not include estimate of smuggled or undocumented production.

[9]Ghana did not produce natural gas nor petroleum in commercially sustainable quantities.

[10]Reported by Ghana Energy Commission.

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TABLE 2
GHANA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum	thousand metric tons	Volta Aluminum Co. Ltd. (Valco) (Government, 90%, and Alcoa Inc., 10%)	Aluminum smelter at Tema (to restart in 2006)	200.
Bauxite	do.	Ghana Bauxite Co. Ltd. (Alcan Aluminum Ltd., 80%, and Government, 20%)	Bauxite mine at Awaso	1,000.
Cement	do.	Ghana Cement Company Ltd. (Heidelberg Zement AG of Germany, 94.5%)	Clinker grinding plant at Takoradi	1,200.
Do.	do.	do.	Clinker grinding plant at Tema	1,200.
Do.	do.	Diamond Cement Ghana Ltd.	Cement plant at Aflao; uses imported clinker	600.
Diamond	thousand carats	Ghana Consolidated Diamonds Ltd. (Government, 100%)	Placer mine at Akwatia Birim Valley	360.
Do.	do.	Artisanal diamond miners	Birim Valley	500 to 900.
Gold	kilograms	AngloGold Ashanti Ltd., 100%	Obuasi underground mine, Ashanti region	17,000.
Do.	do.	AngloGold Ashanti Ltd., 80%, and International Finance Corp., 20%	Iduapriem/Teberebie Mine	8,800.
Do.	do.	AngloGold Ashanti Ltd., 100%	Bibiani Mine	7,000.
Do.	thousand metric tons	Bogoso Gold Ltd. (Golden Star Resources Ltd., 90%, and Government, 10%)	Bogoso carbon-in-leach plant	1,500 ore.
Do.	kilograms	do.	Bogoso/Prestea open pit	5,400.
Do.	thousand metric tons	Wexford Goldfields Ltd. (Golden Star Resources, Ltd., 90%, and Government, 10%)	Wassa carbon-in-leach processing plant	3,500 ore.
Do.	do.	Wexford Goldfields Ltd. (Golden Star Resources, Ltd., 90%, and Government, 10%)	Wassa biooxidation processing plant	3,500 ore.
Do.	kilograms	Wexford Goldfields Ltd. (Golden Star Resources, Ltd., 90%, and Government, 10%)	Wassa Mine, 30 kilometers northwest of Tarkwa	5,200.
Do.	do.	Bogoso Gold Ltd. (Golden Star Resources Ltd., 90%, and Government, 10%)	Prestea underground mine (not operating)	1,100.
Do.	do.	Bonte Gold Mining Ltd. (Akrokeri-Ashanti Gold Mines Inc., 85%; Government, 10%; Buosiako Co. Ltd., 5%)	Placer mine at Jeni River, 40 kilometers southwest of Kumasi (closed in 2004)	2,000.
Do.	thousand metric tons	Gold Fields Ltd., 71.1%; Iamgold Corp., 18.9%; Government, 10%	Tarkwa open pit mine and carbon-in-leach and heap-leach plants, 300 kilometers west of Accra	20,000 ore.
Do.	do.	do.	Damang Mine and carbon-in-leach plant, 360 kilometers west of Accra	4,600 ore.
Do.	kilograms	Newmont Mining Corp., 100%	Ahafo (Yamfo-Sefwi) deposit, near Kenyasi (2006 startup)	17,100.
Do.	do.	do.	Akyem deposit, west of Kibi (2008 startup)	15,500.
Do.	thousand metric tons	Red Back Mining Inc., 100%	Chirano Mine, 100 kilometers from Kumasi, southwest Ghana	2,100 ore.
Do.	kilograms	do.	do.	3,800.
Limestone and lime		Carmeuse Lime Products (Ghana) Ltd. (Carmeuse SA of Belgium)	Takoradi	NA.
Manganese ore	thousand metric tons	Ghana Manganese Company Ltd. (Ghana International Manganese Co., 90%, and Government 10%)	Open pit mine at Nsuta-Wassaw, Western region	1,500.
Petroleum products	thousand barrels	Tema Oil Refinery (Government, 100%)	Refinery at Tema	16,425.
Salt	do.	Panbros Salt Industry Ltd.	Salt pan at Mendskrom, near Accra	NA.
Do.	do.	Elmina Salt Producers Association	Artisanal salt pan mining near Elmina	NA.

NA Not available.

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THE MINERAL INDUSTRY OF GUINEA

By Omayra Bermúdez-Lugo

The Republic of Guinea was among the world's leading producers of bauxite, ranking fourth after Australia, Brazil, and China in terms of bauxite tonnage mined. In 2006, Guinea's production of bauxite together with that of Australia, Brazil, China, and Jamaica accounted for about three-fourths of total world production (Bray, 2007, p. 10.2-10.4). Bauxite mining and alumina operations have historically provided about 80% of the country's foreign exchange. Other commodities produced in the country were cement, diamond, gold, and salt. Undeveloped mineral resources included graphite, iron ore, limestone, manganese, nickel, and uranium.

The Ministère des Mines, de la Géologie et de l'Environnement is the Government agency responsible for the administration of the mining sector. Guinea's Mining Code, which is based on French civil law, was last revised and amended in 1995 and 1998, respectively. The Mining Code established the Centre de Promotion et de Developpement Miniers to deal with all aspects of investment in the mining sector.

In late February and early March 2006, Guinea's main labor union alliance launched a historic general strike demanding wage increases and union participation in the development of Guinea's economic and social policy. As a result of the strike, the unions won a modest salary increase, but in June 2006, a second strike was launched reportedly owing to the Government's inability to control Guinea's rising inflation. The second general strike was marked by intense and widespread violence, which resulted in the deaths of several protesters at the hands of security forces (U.S. Department of State, 2007).

Production

In 2006, production of calcined bauxite declined by 22% to 567,000 metric tons (t) from 730,000 t in 2005; bauxite production, however, increased slightly while diamond and gold production decreased by 13.7% and 27.8%, respectively. Data on mineral production are provided in table 1.

Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities.

Commodity Review

Metals

Bauxite and Alumina.—Alumina Company of Guinea (ACG), Compagnie des Bauxites de Guinée (CBG), and Compagnie des Bauxites de Kindia (CBK) were the country's three bauxite producers. ACG was 100% owned by OAO Russian Aluminium (RUSAL), CBG was a joint venture between Halco Mining Inc. (51%) and the Government (49%), and CBK was 100% owned by RUSAL. Halco, in turn, was a joint venture among Alcan Inc. (Alcan) (45%), Alcoa World Alumina LLC (Alcoa) (45%), and Dadco Group (10%).

Alcoa's basic agreement for the development of the 1.5-million-metric-ton-per-year (Mt/yr) Kamsar alumina refinery was approved by the Guinean National Assembly in May 2006 and was promulgated into law by decree of the President of Guinea in July 2006. During the year, Alcoa completed a biodiversity assessment, a project planning workshop, and the first of a series of meetings on resettlement and community impact for the Kamsar project (Alcoa Inc., 2007, p. 6; Alcoa World Alumina LLC, 2007, p. 12).

In April 2006, RUSAL became the sole owner of the Friguia bauxite and alumina complex. Under the terms of the acquisition agreement signed with the Government for the plant, RUSAL committed to a 3-year expansion program at an investment cost of about $300 million. The expansion program included, among other things, the modernization of existing production systems, installation of new equipment, and expansion of the bauxite mine, which was expected to nearly double production capacity by 2009. The Guinean Government also ceded control of the Dian Dian bauxite concession to RUSAL as part of the company's commitment to develop a bauxite mine and a 2.8-Mt/yr alumina refinery by 2012. The cost of the project was estimated to be $2.5 billion. The project was at the prefeasibility stage in 2006 (OAO Russian Aluminium, 2006a).

In October, RUSAL announced that it had signed an agreement with OAO Sual Holding of Russia and Glencore International AG of Switzerland to merge their respective alumina and aluminum assets under a new company named United Company RUSAL. The companies expected to complete the deal by April 1, 2007, subject to approval by antitrust regulators and the consent of other stakeholders through the exercise of their beneficial rights. If approved, the agreement would create the world's leading alumina and aluminum producer with an annual production volume of about 4 Mt/yr and would employ more than 100,000 people in 17 countries worldwide, including Guinea. The new company would account for about 16% of global alumina production and about 12.5% of global aluminum production (OAO Russian Aluminium, 2006b).

In January 2005, the Government had signed a basic mining agreement with Toronto-based Global Alumina Corporation Ltd. (GAC) for the development of a 2.8-Mt/yr alumina refinery in Boke, which was expected to be completed by 2009. In November 2006, the company announced that it had entered into exclusive negotiations with Melbourne-based BHP Billiton Ltd., Dubai Aluminium Company Ltd. (DUBAL), and Mubadala Development Company PJSC (Mubadala) of the United Arab Emirates for the development of the refinery. If the project were to go ahead, BHP Billiton would hold a 33% interest in the project; DUBAL and Mubadala would hold a 25% and an 8.33% interest, respectively; and GAC would hold the remaining 33% interest in the project. The companies also agreed to provide interim financing of about $100 million to cover project

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expenditures until a definitive agreement was reached and an additional drawdown of $20 million repayable to the respective parties if a definitive joint-venture agreement was not reached by June 1, 2007 (Global Alumina Corporation Ltd, 2006a-c, e, g). Also in January, GAC announced that it had entered into a three-party agreement with the Government and Compagnie des Bauxites de Guinée (CBG) under which CBG would transfer to the Government mining rights for a certain area near GAC's proposed Boke refinery (area not specified). The Government would then transfer the mining rights for the area to GAC (Global Alumina Corporation Ltd., 2006f).

GAC had signed a 40% alumina offtake agreement with DUBAL in 2005, and in 2006, the company entered into a new offtake agreement with Glencore for 420,000 t of the alumina to be produced by the planned Boke refinery. According to GAC, the new agreement secured long-term offtake agreements for about 55% of GAC's envisioned annual alumina production for a period of 20 years (Global Alumina Corporation Ltd., 2006d).

Gold.—Gold in Guinea occurred as veins and alluvial deposits and was mined at artisanal, small, and industrial scales. The country's main gold-bearing area was the Siguiri Basin, which is located within the Upper Guinea region. Gold is also found in the Fitaba, the N'Zerekore, and the Sierra-Fore areas and was produced by Société Ashanti de Guinée (SAG), Société d'Exploitation Minière d'Afrique de l'Ouest-Guinée (SEMAFO-Guinée), Société Minière de Dinguiraye (SMD), and artisanal and small-scale miners.

Cassidy Gold Corp. of Canada held interest in the seven concession areas of the Kouroussa project, which are located about 570 kilometers (km) from the city of Conakry; these concessions included the 240-square-kilometer (km^2) Kouroussa property; the 161-km^2 Kouroussa North property; the 86-km^2 Kouroussa South Block 1 property; the 114-km^2 Kouroussa South Block 2 property; the 226-km^2 Kouroussa West property; the 207-km^2 Tambiko Mina property; and the 36-km^2 Tambiko Mina Block 2 property. In September 2006, Cassidy Gold announced updated resource figures for the Kouroussa project. The resource estimate, which was reportedly interpreted and validated by RSG Global Consulting Pty Ltd. of Australia, yielded an indicated resource of about 4.38 million metric tons (Mt) at a grade of 2.4 grams per metric ton (g/t) gold and an inferred resource of about 5.8 Mt at a grade of 1.97 g/t gold. The company planned to continue with the next phase of resource and exploratory drilling, which consisted of 30,000 meters (m) of reverse-circulation drilling, 5,000 m of diamond drilling, and 5,000 m of aircore drilling focused on the KD-1, the Kinkine, and the Sanu Folo deposits (Cassidy Gold Corp., 2006, 2007).

In January 2006, SearchGold Resources Inc. of Canada signed an option agreement with Bouré Gold Fields SARL to acquire a 100% interest in the 487-km^2 Mandiana gold property. Termite mound surveys were carried out during the year and a 3,000-m drilling program was started on December 26. Previous exploration by other companies had reportedly produced preliminary drill results of about 3.68 g/t gold at the Karfakolo prospect, and 1.89 g/t gold and 0.94 g/t gold at the Intercolonial prospect. Previous soil geochemical sampling had yielded assays of as much as 65 g/t gold at the N'Diambaye prospect (SearchGold Resources Inc., 2006).

SAG, which was owned by AngloGold Ashanti Ltd. (85%) and the Government (15%), operated the Siguiri gold mine, which is located 800 km from Conakry in northeastern Guinea. In 2006, production at the Siguiri Mine increased by about 4% to 9,362 kilograms (kg) from 8,989 kg produced in 2005. The company attributed the increase in production to the transition from heap-leach operations to a newly commissioned carbon-in-pulp (CIP) plant, which allowed for the mining of saprolitic ores (AngloGold Ashanti Ltd., 2007, p. 71-72).

In June 2006, London-based Crew Gold Corp. acquired the remaining 15% interest in the Lefa Corridor gold project and the Lefa gold mine from the Government. The project had been previously owned 85% by Guinor Gold Corp. of Canada (Crew Gold acquired Guinor in December 2005). Prior to its acquisition by Crew Gold, Lefa Mine had been operated for more than 11 years as a heap-leach operation. A $196 million expansion of the mine was completed by Crew Gold in December 2006 and included the construction of a 7-Mt/yr CIP plant. The CIP plant nameplate production capacity was about 10,900 kilograms per year (kg/yr) (reported as 350,000 troy ounces); full production was expected to be reached in the second quarter of 2007. The company reported that, owing to continuing exploration of the Lefa Corridor, measured and indicated resource estimates for the project increased to 150,000 kg (reported as 4.82 million troy ounces) from about 119,000 kg (reported as 3.84 million troy ounces) (Crew Gold Corp., 2007, p. 5).

SEMAFO-Guinée operated the Kiniero Mine, which is located about 650 km east of the city of Conakry near the town of Kouroussa. The company was owned by Semafo Inc. of Canada (85%) and the Government (15%). The Kiniero Mine produced about 1,468 kg (reported as 47,200 troy ounces) of gold in 2006 compared with 1,900 kg (reported as 61,416 troy ounces) in 2005. The decrease in production was attributed to the processing of lower grade ore. The company's exploration budget for 2007 was $3.1 million and was targeted at increasing the Kiniero Mine reserves by more than 3,100 kg (reported as 100,000 troy ounces). Mineral reserves at the Kiniero Mine were about 3.17 Mt at a grade of 4.28 g/t gold; total measured and indicated resources were about 8.84 Mt at a grade of 2.67 g/t gold (Semafo Inc., 2007a, p. 5, 9, 12; 2007b).

Other companies exploring for gold in the country included Australia-based Burey Gold Ltd. (formerly Mamba Resources Ltd.; the name was changed in March 2006), which entered into a farm-in and joint-venture agreement with Australia-based Caspian Oil and Gas Ltd. to earn a 70% interest in the Mansounia gold project, and Wega Mining ASA of Norway, which held nine exploration licenses in the Guinea Haute region (Burey Gold Ltd., 2006, p. 14; Wega Mining ASA, 2007, p. 28-30).

Iron Ore.—Guinea hosted the Mount Nimba and the Simandou iron ore deposits in the southeastern part of the country. The iron content of these banded iron formation deposits was estimated to be between 66% and 68%. Simandou, which is located along a 115-km-long mountain range in southeastern Guinea within Beyla, Kerouane and Macenta

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Prefectures, hosts the Pic de Fon iron ore deposit. Resources at Pic de Fon were estimated to be about 1.2 billion metric tons (Gt) of iron ore. Lateritic iron deposits occur in Lower Guinea and include the Kaloum Peninsula deposit in the Conakry region and other deposits in Forecariah Prefecture. Other iron ore occurrences were identified in the regions of Upper Guinea, Middle Guinea, and Forest Guinea (Ministry of Mines and Geology, 2005c).

In April 2006, London-based Rio Tinto plc through its wholly owned subsidiary SIMFER S.A. was granted a mining concession for the development of the Simandou iron ore project. The company was working on a prefeasibility study for the Pic de Fon deposit (Rio Tinto plc, 2006). The International Finance Corporation (IFC) held a 5% interest in SIMFER. The IFC was to support Rio Tinto and the Guinean Government in conducting the necessary feasibility studies, environmental and social studies, and transportation studies for the development of the Simandou project (International Finance Corporation, 2006).

Other Metals.—In December, Canadian company Mega Uranium Ltd. announced the beginning of a 5,000-m diamond drilling program to test several targets at the Mount Kakoulima copper-nickel-cobalt and platinum-group metal polymetallic deposit, which is located about 35 to 50 km northeast of the city of Conakry. Mega was to invest $2 million or complete a bankable feasibility study to acquire a 100% interest in the project (Mega Uranium Ltd., 2006).

Industrial Minerals

Diamond.—Guinea's main diamond deposits are located in Kerouane, Kissidougou, and Macenta Prefectures along the Baoule, the Diani, and the Milo Rivers. Other diamond occurrences were identified in Forecariah and Kindia Prefectures. Diamond was mined from alluvial, eluvial, and kimberlite deposits. Artisanal and small-scale mining was concentrated mainly in the Banankoro area in Kerouane, on lands reserved by the Government in the Aredor-FCMC SA concession along the Boule River and its tributaries, and in Kindia. Guinea was a participant in the Kimberley Process. Diamond was exported through the National Bureau of Expertise (BNE), which evaluated the diamond and issued certificates of origin in compliance with the Kimberley Process. BNE collected a 3% tax on diamond exports (Ministry of Mines and Geology, 2005a, b).

In 2006, diamond production decreased by about 14% to 474,000 carats from a revised 549,000 carats in 2005. African Diamonds plc operated a trial mine on an alluvial diamond resource along the Bomboko River. The company planned to expand the operation during 2007 by using additional processing equipment, which was to be shipped from a former diamond operation in Sierra Leone (African Diamonds plc, 2007, p. 3, 16).

In March 2006, Canada-based Mano River Resources Inc. and SearchGold signed a joint-venture agreement to develop a diamond mine on SearchGold's Mandala-Ouria alluvial diamond property and to determine the economic potential of Mano River's Bouro kimberlite dykes in the Bouro District. During the year, an engineering study was carried out to design a dual alluvial/kimberlite treatment plant and a field program was initiated to evaluate the existing infrastructure. The company was also to conduct a sampling program to evaluate the alluvial potential of the Mandala-Ouria permit. A budget of $3 million was assigned for the first year of the project, which was to be funded equally by each company (African Mining, 2006; SearchGold Resources Inc., 2006).

De Beers Consolidated Mines Ltd. obtained three diamond exploration permits in 2006 for the Macenta area in southeastern Guinea. Diamond resources in the area have been estimated to be about 100,000 carats (Business Report, 2006).

Mineral Fuels and Related Materials

Petroleum.—Guinea did not produce or refine petroleum and was dependent upon imports for its petroleum requirements. Houston-based Hyperdynamics Corp. (HC) held a 31,000-square-mile acreage offshore Guinea, which was the largest offshore area for petroleum exploration in West Africa. HC began studying existing seismic data for this area in 2002. In September 2006, the company, through its wholly owned subsidiary SCS Corp. signed a production-sharing contract (PSC) with the Government for the exclusive rights to the acreage. Under the PSC, Hyperdynamics has the exclusive rights for exploration, development, and production for approximately 11,000 square miles of the total 31,000-square-mile area (Hyperdynamics Corp., 2006; 2007, p. 4-5).

Uranium.—Australian-based Murchison United NL held six uranium prospecting licenses for three separate concession areas known as Bohodou, Firawa, and Sesse. As of the end of June 2006, the company had completed its initial drilling program at the Firawa prospect and announced that the assay results confirmed significant uranium intersections (Murchison United NL, 2006a, p. 10-11; 2006b).

Perth-based Nova Energy Ltd. held two exploration licenses in northern Guinea. Previous exploration undertaken during the 1970s reportedly had identified uranium mineralization in the area grading from 0.01% to 0.5% U_3O_8, and the company was in the process of verifying this data. Nova planned to locate mineralized units and conduct ground radiometric and geochemical surveys in the area (Nova Energy Ltd., 2006).

Outlook

Mining, and particularly ongoing projects in the bauxite and alumina sectors are likely to play a significant role in Guinea's economic development in the next 3 to 6 years. If Alcoa's, GAC's, and RUSAL's projects are delivered as scheduled, Guinea's installed alumina production capacity will increase to 7.1 Mt/yr by 2012 from its current 640,000 t/yr. Rio Tinto's iron ore Simandou project, which was at the prefeasibility stage, as well as ongoing diamond, gold, and petroleum exploration and the presence of such major players in the international mining sector as BHP Billiton, De Beers, Rio Tinto, and RUSAL suggest that foreign direct investment in the mining sector is likely to continue to grow in the coming years.

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TABLE 1
GUINEA: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]		2002	2003[e]	2004[e]	2005[e]	2006
Alumina:						
Production:						
Hydrate		44	8	10	10	6 [e]
Calcined		680	730	877	730	567 [3]
Shipments, calcined		724	738	887	740 [4]	NA
Bauxite:						
Mine production:						
Wet basis[5]		17,480	17,044 [4]	17,200	16,817 [r, 3]	16,956 [3]
Dry basis[e, 6]		15,300	15,000	15,254 [4]	14,600 [r]	14,800
Shipments (dry basis):						
Metallurgical		14,087	13,939 [4]	14,100	14,100	NA
Cement		360	360	360	360	360
Diamond[7, 8]	thousand carats	491	666	674 [r, 9]	549 [r, 9]	474 [9]
Gold[8]	kilograms	16,815	16,622 [4]	11,100	25,097 [r, 3]	18,147 [3]
Salt[e]		15	15	15	15	15

[e]Estimated; estimated data are rounded to no more than three significant digits. NA not available. [r]Revised. -- Zero.
[1]Table includes data available through November 19, 2007.
[2]In addition to the commodities listed, Guinea produced modest quantities of crude construction materials (clays, sand and gravel, and stone), but information is inadequate to make reliable estimates of output.
[3]Reported by the Ministère de l'Économie, des Finances et du Plan.
[4]Reported figure.
[5]Metallurgical ore plus calcinable ore estimated to be 13% water.
[6]Data are for wet-basis ore estimated to be 13% water reduced to dry basis estimated to be 3% water.
[7]Production is approximately 70% to 80% gem quality.
[8]Figures include artisanal production.
[9]Kimberley Process Certification Scheme.

TABLE 2
GUINEA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Alumina		Alumina Company of Guinea [OAO Russian Aluminium (RUSAL), 100%]	Friguia plant, Fria Prefecture	640,000.
Bauxite		Compagnie des Bauxites de Guinée (CBG) [Halco Mining Inc., 51%, and Government, 49% (Halco Mining is a consortium formed by Alcoa Inc., 45%; Alcan Inc., 45%; and Dadco Group, 10%)]	Kamsar and Sangaredi	14,000,000.
Do.		Compagnie des Bauxites de Kindia (CBK) [OAO Russian Aluminium (RUSAL), 100%]	Debele Mine, Kindia Prefecture	3,000,000.
Do.		Alumina Company of Guinea [OAO Russian Aluminium (RUSAL), 100%]	Friguia Mine, Fria Prefecture	2,800,000.
Cement		Ciments de Guinée (Holcim Ltd., 51%, and Government, 44%)	Plant at Conakry city	360,000.
Diamond	carats	Aredor-First City Mining Company (Government, 15%, and Trivalence Mining Corporation, 85%)	Aredor Mine	38,000.
Do.	do.	Artisanal miners	Mainly in Banankoro	700,000.
Gold	kilograms	Société Ashanti de Guinée (AngloGold Ashanti Ltd., 85%, and Government, 15%)	Siguiri Mine, 800 kilometers from Conakry	9,000,000 ore; 9,300 gold.
Do.	do.	Société Minière de Dinguiraye (Guinor Gold Corp., 85%, and Government, 15%)	Lero-Karta Mine	1,100,000 ore; 3,500 gold.
Do.	do.	Société d'Exploitation Minière d'Afrique de l'Ouest Guinée (Semafo Inc., 85%, and Government, 15%)	Kiniero Mine	400,000 ore; 1,700 gold.
Do.	do.	Crew Gold Corp., 100%	Lefa Mine	10,900 gold.

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The Mineral Industries of the Indian Ocean Islands

Comoros, Mauritius, Reunion, and Seychelles

By Thomas R. Yager

COMOROS

The Federal Islamic Republic of the Comoros is located on three main islands in the Mozambique Channel. In 2006, the mineral industry of Comoros continued to be limited to the production of such construction materials as clay, sand and gravel, and crushed stone for local consumption. Mineral production data continued to be unavailable. Comoros did not play a significant role in the world's production or consumption of minerals.

The demand for cement, steel, and petroleum products was met through imports. In 2005 (the latest year for which data were available), imports of petroleum products accounted for 12% of total imports; cement, 8%; and iron and steel, nearly 4%. Imports of cement amounted to 55,867 metric tons (t); petroleum products, 20,487 t; and iron and steel, 3,678 t (International Monetary Fund, 2006, p. 56).

Reference Cited

International Monetary Fund, 2006, Union of the Comoros—Selected issues and statistical appendix: Washington, DC, International Monetary Fund, October 30, 65 p.

MAURITIUS

The Republic of Mauritius is located about 1,000 kilometers (km) east of Madagascar. In 2006, Mauritius produced basalt for construction, fertilizers, lime from coral, semimanufactured steel, and solar-evaporated sea salt. Local companies also cut imported diamond. Mauritius did not play a significant role in the world's production or consumption of minerals.

Imports of mineral fuels accounted for 17% of total imports; iron and steel, 2%; and cement, 1%. In March 2006, concerns about import reliance and rising petroleum prices led the Government to sign an agreement with ONGC Videsh Ltd. of India for offshore petroleum exploration (Reuters Ltd., 2006; Mauritius Central Statistics Office, 2007, p. 18-19).

Production

In 2006, the production of sand increased by 52%; semimanufactured steel, by 2%; and fertilizers, by 1%. The reported value of sand production amounted to about $1 million (M.V.D. Domun, Principal Research and Development Officer, Agricultural Information Division, Ministry of Agro Industry and Fisheries, written commun., August 17, 2007).

Structure of the Mineral Industry

Aggregates were produced by Gamma Civic Ltd. and United Basalt Products Ltd.; fertilizers, by Mauritius Chemical and Fertilizer Industry Ltd.; salt, by Mont Calme Ltd.; and semimanufactured steel, by Consolidated Steel Ltd. These companies were privately owned.

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REUNION

Reunion, which is an overseas department of France, is located about 650 km east of Madagascar. Production of mineral commodities represented only a small part of the economy of Reunion, although little quantitative information was available. Aggregates, cement, and seacoast coral continued to meet local construction needs. Reunion was not a globally significant mineral producer or consumer.

Production

Holcim (Reunion) S.A. produced an estimated 400,000 t of cement by grinding imported clinker. The company also produced 1.3 million metric tons of aggregates from plants at Bras Panon and Saint-Joseph.

Structure of the Mineral Industry

Holcim (Reunion) S.A. was the most significant producer of mineral products in Reunion. It was privately owned.

SEYCHELLES

The Republic of Seychelles is a group of 40 granitic and 50 or more coralline islands that is located northeast of Madagascar in the Indian Ocean. The country's mineral industry consisted mostly of production of such construction materials as clay, coral, sand, and stone. Seychelles was not a globally significant mineral producer or consumer. In 2006, imports of mineral fuels accounted for about 27% of the value of total imports (Central Bank of Seychelles, 2007, p. 45).

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Production

Seychelles was estimated to produce about 210,000 metric tons per year (t/yr) of gravel and crushed stone, 93,000 t/yr of granite, and 8,100 t/yr of sand.

Structure of the Mineral Industry

Civil Construction Company Ltd., Gondwana Granite Ltd., and United Concrete Products (Seychelles) Ltd. produced construction materials. These companies were privately owned.

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Central Bank of Seychelles, 2007, Annual report 2006: Victoria, Seychelles, Central Bank of Seychelles, 105 p.

TABLE 1
MAURITIUS, REUNION, AND SEYCHELLES: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Country and commodity	2002	2003	2004[e]	2005[e]	2006[e]
MAURITIUS[2]					
Fertilizers	83,000 [r]	89,380 [r]	89,400 [3]	85,000 [r,3]	86,000 [3]
Salt, marine	7,000	7,200	7,000 [r,3]	7,900 [3]	8,000
Sand	300,000 [r,e]	60,000 [r,e]	60,000 [r]	60,135 [r,3]	91,422 [3]
Steel, semimanufactures	51,400 [r]	58,700	59,000 [r,3]	60,500 [r,3]	62,000 [3]
REUNION[e,4]					
Aggregates	1,300,000	1,300,000	1,300,000	1,300,000	1,300,000
Cement	380,000	380,000	380,000	380,000	400,000
SEYCHELLES					
Dimension stone, granite	97,576	92,120	93,000	93,000	93,000
Gravel and crushed stone	239,746	212,926	210,000 [r]	210,000 [r]	210,000
Sand[e]	8,100 [r]	8,100 [r]	8,100 [r]	8,100 [r]	8,100

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised. -- Zero.
[1]Table includes data available through September 19, 2007.
[2]In addition to the commodities listed, asphalt, basalt, and lime are also known to be produced, but information is inadequate to make reliable estimates of output.
[3]Reported figure.
[4]In addition to the commodities listed, coral and volcanic rock are also known to be produced, but information is inadequate to make reliable estimates of output.

TABLE 2
MAURITIUS, REUNION, AND SEYCHELLES: STRUCTURE OF THE MINERAL INDUSTRIES IN 2006

(Metric tons unless otherwise specified)

Country and commodity	Major operating companies	Location of main facilities	Annual capacity
MAURITIUS			
Aggregates	United Basalt Products Ltd.	La Mecque	660,000.[e]
Do.	Gamma Civic Ltd.	Beau Bassin and Solitude	NA.
Fertilizers	Mauritius Chemical and Fertilizer Industry Ltd.	Port Louis	100,000.
Salt	Mont Calme Ltd.	Tamarin	NA.
Steel	Consolidated Steel Ltd.	Port Louis	85,000 rebar.
REUNION			
Aggregates	Holcim (Reunion) S.A.	Bras Panon and Saint-Joseph	1,300,000.[e]
Cement	do.	Le Port	400,000.
SEYCHELLES			
Granite	Gondwana Granite Ltd.	Victoria	NA.
Gravel and crushed stone	United Concrete Products (Seychelles) Ltd.	Anse des Genets	150,000.[e]
Do.	Civil Construction Company Ltd.	Brilliant	97,000.[e]

[e]Estimated. NA Not available.

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THE MINERAL INDUSTRY OF KENYA

By Thomas R. Yager

In 2006, Kenya played a significant role in the world's production of fluorspar and natural soda ash. The country's share of the world's mine production of soda ash amounted to 3%, and that of fluorspar, nearly 2%. Other significant mineral processing operations included cement and petroleum refining. Kenya was not a globally significant consumer of minerals (Kostick, 2007; Miller, 2007).

Minerals in the National Economy

In 2006, the manufacturing sector accounted for 9.9% of the gross domestic product, and mining and quarrying, 0.5%. The mining and quarrying sector grew by 4.1% in 2006. Mineral exports accounted for between 2% and 3% of Kenya's total exports. Mining and quarrying was estimated to employ more than 50,000 Kenyans (Central Bank of Kenya, 2007, p. 15-16; Poggiolini, 2007).

Production

The production of fluorspar declined by nearly 15% in 2006. From 2002 to 2005, the production of ruby increased by 68%; carbon dioxide, 54%; cement, 45%; and soda ash, 18%. During the same period, Kenya's diatomite production declined by 82%, and gold, 58%.

Structure of the Mineral Industry

Most of Kenya's mining and mineral processing operations were privately owned, including the diatomite, fluorspar, gemstone, salt, and soda ash mines, the lime plants, and the steel mills. In 2006, Tata Chemicals Ltd. of India purchased a 63.5% share in the Brunner Mond Group Ltd., which was the parent company of Magadi Soda Ash Ltd. Athi River Mining Ltd. (ARM) and Bamburi Cement Ltd. were privately owned. The Government held a 52% share in East Africa Portland Cement Co. Ltd. (EAPC) and a 50% share in Kenya Petroleum Refineries Ltd. (KPRL).

Commodity Review

Metals

Gold.—Artisanal miners produced gold in Nyanza, Rift Valley, and Western Provinces. Kansai Mining Corp. of Canada and Mid Migori Mining Company Ltd. were engaged in a joint venture to explore for gold in the Migori District of Nyanza Province. AfriOre Ltd. of Canada explored in the Siaya District of Nyanza Province and the Kakamega District of Western Province. International Gold Exploration AB of Sweden had properties in Nyanza and Rift Valley Provinces; the company sought joint-venture partners for exploration (Poggiolini, 2007).

Titanium and Zirconium.—Tiomin Resources Inc. of Canada planned to mine at the Kwale heavy mineral sands deposit after completing construction of the mine by mid-2008. The company was expected to produce 330,000 metric tons per year (t/yr) of ilmenite, 75,000 t/yr of rutile, and 37,000 t/yr of zircon in the first 6 years of the project. Capital costs for the project were estimated to be $178 million. In December 2006, Tiomin declared force majeure at Kwale because of disputes concerning land ownership with local farmers; the company also had disputes with the Government concerning port tariffs and taxation (Industrial Minerals, 2006; Poggiolini, 2007).

Industrial Minerals

Cement.—In 2006, Kenya had three cement producers with a combined capacity of 3 million metric tons per year (Mt/yr). National cement production increased to about 2.2 million metric tons (Mt) in 2006 from 2.12 Mt in 2005 and 1.79 Mt in 2004.

Bamburi Cement was conducting a feasibility study on building a new cement plant with a capacity of 2.6 Mt/yr; costs of the new plant were estimated to be $150 million. EAPC planned to increase its capacity to 1.2 Mt/yr from 600,000 t/yr by late 2007. In late 2006, ARM completed an expansion of its capacity to 300,000 t/yr from 120,000 t/yr. The company was considering a further 50% increase in its capacity by November 2007 (East African Portland Cement Co. Ltd., 2006; Kenya Engineer, 2006; Mogusu, 2006; Hoffman, 2007; Brown and Hoffman, undated).

In 2006, Kenya's cement consumption amounted to nearly 1.77 Mt compared with 1.57 Mt in 2005. The increase was partially attributable to growth in the residential construction sector and increased spending on road construction (Central Bank of Kenya, 2007, p. 21).

Fluorspar.—Kenya Fluorspar Ltd. produced acid-grade fluorspar in the Keiro Valley for export markets. In 2005, the value of fluorspar exports was $1.45 million, or 17% of mineral exports. Domestic reserves amounted to about 2 Mt of contained fluorspar (Miller, 2007; E.S. Osumo, Mines and Geology Department, written commun., July 7, 2006).

Gemstones.—Kenya produced gemstones that included amethyst, aquamarine, cordierite, garnet, ruby, sapphire, and tourmaline. Rockland Kenya Ltd., which operated the John Saul ruby mine, was the leading ruby producer. The Scorpion Mine produced tsavorite, which is a green grossular garnet that obtains its color from trace amounts of chromium and vanadium.

Soda Ash.—Magadi Soda Ash Ltd. mined trona from Lake Magadi. The production of soda ash increased to 374,010 metric tons (t) in 2006 from 360,161 t in 2005 (table 1). Magadi's production of soda ash and crushed refined soda accounted for 77% of the value of Kenya's mineral production in 2005. The company finished a new processing plant that increased capacity to 715,000 t/yr from 350,000 t/yr (table 2) (Brunner Mond Group Ltd., 2007; E.S. Osumo, Mines and Geology Department, written commun., July 7, 2006).

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From 2001 to 2005, about 90% of Kenya's soda ash production was exported. Soda ash was consumed domestically by ARM in the production of sodium silicate, which was used in detergents, soaps, and chemical and metallurgical applications. By the end of 2006, ARM planned to increase its sodium silicate capacity to 60,000 t/yr from 40,000 t/yr (Mogusu, 2006; Brown and Hoffman, undated; E.S. Osumo, Mines and Geology Department, written commun., July 7, 2006).

Mineral Fuels

Petroleum.—KPRL produced refined petroleum products from imported crude petroleum. The use of outdated equipment at the refinery reportedly cost the Kenyan economy nearly $67 million per year. The company planned to upgrade the refinery to increase liquefied petroleum gas production to about 1.33 million barrels per year (Kathuri, 2006).

In April 2006, the Government awarded the exploration rights to Blocks 1, 9, 10A, L2, L3, and L4 to China National Offshore Oil Company Ltd. The company held 28% of Kenya's petroleum exploration acreage. A joint venture of Woodside Energy Ltd. of Australia (30%), Dana Petroleum plc of the United Kingdom (30%), Repsol Exploration SA (20%), and Star Petroleum International (Kenya) Ltd. (20%) [a subsidiary of Global Petroleum Ltd. of Australia] explored at offshore Blocks L5 and L7. Pancontinental Oil and Gas NL of Australia had joint-venture agreements to explore in offshore Block L6 with Gippsland Offshore Petroleum Ltd. of Australia, and in Blocks L8 and L9 with Origin Energy Ltd. of Australia (East African, 2006).

Outlook

Cement production was likely to increase because of the increased capacity at ARM and EAPC. If the recent broad-based increase in world minerals demand continues, Kenyan production of fluorspar and soda ash is likely to increase. The outlook for titanium minerals depends on the resolution of disputes concerning land ownership, port tariffs, and taxation.

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Poggiolini, David, 2007, Kenya—Mining on the agenda: African Mining, v. 12, no. 1, January/February, p. 54-57.

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TABLE I
KENYA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004	2005	2006[e]
Aluminum, secondary[e]		2,400	2,400	2,400	2,400	2,400
Carbon dioxide gas, natural		5,662	4,614	5,982	8,723	9,359 [3]
Cement, hydraulic	thousand metric tons	1,463	1,658	1,789	2,123	2,200
Clays:[e]						
Bentonite		50	50	50	50 [r]	60
Kaolin		720	740	760	780	780
Other		18,000	19,000	20,000	20,000	20,000
Diatomite[4]		1,333	353	330	243	185 [3]
Feldspar		60	50	40	22 [3]	25
Fluorspar, acid grade		98,007 [r]	95,278	108,000 [r]	97,261 [r]	83,000 [3]
Gemstones, precious and semiprecious:[e]						
Amethyst	kilograms	500	300	82 [3]	73 [3]	75
Aquamarine	do.	230	280	331 [3]	250	260
Cordierite, iolite	do.	190	140	92 [3]	81 [3]	85
Green garnet	do.	1,100	600	1,603 [3]	800	830
Ruby	do.	3,043 [3]	2,310 [3]	4,758 [3]	5,100	5,300
Sapphire	do.	1,800	1,400	2,000	3,500	3,600
Tourmaline	do.	11,000	7,000	4,000	8,000	8,300
Gold, mine output, Au content[4]	do.	1,477	1,543	567	616	432 [3]
Gypsum and anhydrite[e]		8,400	8,700	8,900	9,100	9,100
Iron ore[e]		900	700	500	300 [3]	300
Lead, refined secondary		1,000	1,000	1,000	1,000	1,000
Lime[e]		50,000	50,000	50,000 [r]	50,000	50,000
Petroleum refinery products:						
Gasoline	thousand 42-gallon barrels	2,158	2,243	2,346	2,200 [e]	2,200
Kerosene and jet fuel	do.	2,148	2,298	2,416	2,300 [e]	2,300
Distillate fuel oil	do.	3,021	3,066	2,887	2,800 [e]	2,800
Residual fuel oil	do.	3,550	3,490	4,129	4,000 [e]	4,000
Liquefied petroleum gas	do.	278	499	313	300 [e]	300
Other[e]	do.	100	110	110	100	100
Total[e]	do.	11,300	11,700	12,200	11,700	11,700
Salt, crude[e]		46,000	48,000	60,000	52,000	60,000
Soda ash		304,110	352,560	353,835	360,161	374,210 [3]
Stone, sand and gravel:[e]						
Granite for dimension stone		180	190	200	200	200
Limestone for cement	thousand metric tons	710	800	870	1,000	1,000
Limestone for dimension stone		32,000 [3]	33,000	34,000	35,000	35,000
Marble for dimension stone		120	130	130	130	130
Sand, industrial; glass		12,000	13,000	13,000	13,000	13,000
Shale		190,000	200,000	210,000	210,000	210,000
Sulfuric acid		20,000	20,000	20,000 [e]	20,000 [e]	20,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised.

[1]Table includes data available through July 9, 2007.

[2]In addition to the commodities listed, a variety of minerals and construction materials [brick clays, coal, gravel, meerschaum, mica, murram (laterite), crushed rock, and construction sand] may be produced, but quantities are not reported, and available information is inadequate to make estimates of output.

[3]Reported figure.

[4]Exports.

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TABLE 2
KENYA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity
Carbon dioxide gas, natural		Carbacid Ltd.	Mine at Kereita	10,000 e
Cement		Bamburi Cement Ltd. (Lafarge Group, 73%)	Plant at Mombasa	1,100,000
Do.		do.	Plant at Nairobi	1,000,000
Do.		East African Portland Cement Co. Ltd. (EAPC) (LaFarge Group, 41%; National Social Security Fund, 27%; Government, 25%)	Plant at Athi River	600,000
Do.		Athi River Mining Ltd. (ARM)	Plant at Kaloleni	300,000
Diatomite		African Diatomite Industries Ltd.	Kariandusi and Soysambu	4,000
Fluorspar		Kenya Fluorspar Ltd.	Mine at Kerio Valley	120,000
Garnet	kilograms	Bridges Exploration Ltd.	Scorpion Mine in Taita Taveta	40
Glass		Central Glass Industries Ltd.	Plant at Nairobi	51,100
Do.		Impala Glass Industries Ltd.	do.	NA
Gold	kilograms	Artisanal miners	Mines in Nyanza, Rift Valley, and Western Provinces	NA
Lead, refined secondary		Associated Battery Manufacturers Co. Ltd.	Plant at Athi River	3,000
Lime		Homa Lime Company Ltd.	Plant at Koru	30,000
Do.		Athi River Mining Ltd. (ARM)	Plant at Kaloleni	24,000
Petroleum, refined	thousand 42-gallon barrels	Kenya Petroleum Refineries Ltd. (KPRL) (Government, 50%; Royal Dutch Shell Group, 17.1%; British Petroleum plc, 17.1%; and Chevron Corp., 15.8%)	Refinery at Mombasa	32,850
Ruby	kilograms	Rockland Kenya Ltd.	Mine at Kasigau	1,500 e
Salt		Magadi Soda Ash Ltd. (Brunner Mond Group Ltd., 100%)	Mine at Magadi	40,000
Do.		Krystalline Salt Ltd.	Mine at Nairobi	NA
Do.		Mombasa Salt Works Ltd.	Mine at Mombasa	NA
Soda ash		Magadi Soda Ash Ltd.	Mine at Magadi	715,000
Sodium silicate		Athi River Mining Ltd. (ARM)	Plants at Athi River and Kaloleni	40,000
Steel:[1]				
Crude[2]		Kenya United Steel Co. Ltd. (E.A. Wire Industries Ltd., 81%)	Plant at Mombasa	20,000
Rolled		Mabati Rolling Mills Ltd.	do.	120,000
Do.		Standard Rolling Mills Ltd.	do.	40,000
Do.		Kenya United Steel Co. Ltd.	do.	30,000
Do.		Steelmakers Ltd.	do.	30,000
Sulfuric acid		Kel Chemicals Ltd.	Plant at Thika	32,000
Do.		East African Heavy Chemicals	Plant at Webuye	NA
Vermiculite[3]		Kenmag Investments Ltd.	Mine at Lodosoit	2,000

eEstimated. NA Not available.
[1]In addition to its crude and rolled steel facilities, Kenya has three galvanized steel plants with a capacity of 210,000 metric tons per year (t/yr).
[2]Has not operated since 1998.
[3]Has not operated since 2000.

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The Mineral Industries of Lesotho and Swaziland

By Harold R. Newman

LESOTHO

The mining and quarrying sector was a marginal contributor to the gross domestic product (GDP) of Lesotho. Although the country was believed to have significant mineral deposits, attempts at exploitation continued to be limited owing to lack of investment interest. Known deposits included base metals, clays, diamond, dimension stone, sand and gravel, and uranium. In northern Lesotho, the Lesotho Geological Survey (LGS) identified 33 kimberlite pipes and 140 dykes, of which 24 are diamondiferous. The kimberlite pipes and dykes are of lower Cretaceous age. As estimated by the LGS, the country was thought to have the world's most dense concentration of kimberlite pipes per hectare. Reserves of coal and bituminous shale have been identified in several areas of the country (South Africa Development Community, 2006, p. 3).

Production

Data on mineral production are provided in table 1.

Structure of the Mineral Industry

The primary change in the structure of Lesotho's mineral industry in 2006 was that Gem Diamond Mining Co. Ltd. of South Africa purchased the entire shareholding of 76% in Diamonds (Pty) Ltd., which operated the Letseng Mine. The remaining equity (24%) was owned by the Government (table 2).

Commodity Review

Industrial Minerals

Diamond.—European Diamonds plc announced development plans for the kimberlite Main Pipe at Lighobong, the targeted production of which was an initial 500,000 carats per year. A prefeasibility study was underway in 2006, and a full feasibility study was planned for 2007 to determine the feasibility of mining the Main Pipe. Additional core drilling to refine the geologic model and to assist in the development of the feasibility study was carried out in the latter part of 2006. European Diamonds signed an agreement with the Government of Lesotho that extended the scope of its mining license at Lighobong. In December 2006, a 27.7-carat clean D-color stone was recovered from the Main Pipe and sold in Antwerp, Belgium, for a reported $750,000 (European Diamonds plc, 2006, p. 1).

The Letseng Mine, which was famous worldwide for the quality and size of its diamond, consists of two primary vertical pipes, together with deposits of alluvial gravel. The pipes are adjacent to one another and are made up of cone-shaped sections with vertical depths of 495 meters (m) and 655 m, respectively. Approximately 14% of the stones mined have been larger than 10.8 carats. Letseng has produced three of the world's largest diamonds: the 610-carat Lesotho Brown in the mid-1960s, the 123-carat Star of Lesotho in October 2004, and the 603-carat Lesotho Promise in September 2006. The Lesotho Promise sold for $12.4 million (Gem Diamonds Ltd., 2006).

Outlook

Diamond production is likely to increase in 2007, but the outlook for the remainder of Lesotho's mineral industry was for little change in the near future. Limited investment in the mineral sector and high rates of HIV/AIDS infection among Lesotho's population were likely to constrain development of the mining sector.

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SWAZILAND

Mining has declined in importance in Swaziland in recent years and, in 2006, the mineral industry of Swaziland was not a significant contributor to the country's GDP. Mineral activities accounted for about 2% of the GDP, an even smaller percentage of the value of exports, and about 1% of the work force (U.S. Central Intelligence Agency, 2006).

Production

In 2006, the mineral industry in Swaziland showed an increase in the production of anthracite coal and ferrovanadium and a decrease in stone quarrying. The quarrying of stone was for domestic consumption.

Xstrata plc of Switzerland operated a ferrovanadium plant at Maloma with a capacity of 2,400 metric tons per year. Production of ferrovanadium at the plant rose to 491 metric tons (t) in 2006 from 345 t in 2005 (Investors Chronical, 2007).

Coal production at Xstrata's Maloma Mine increased to 310,570 t from 221,701 t in 2005 (table 1). The anthracite coal produced at the Maloma Mine and plant that was not used for ferrovanadium production was exported to South Africa for use in Xstrata's other ferrochromium plants (Mbendi, 2006b).

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Structure of the Mineral Industry

The principal mining and mineral processing facilities in Swaziland, with their locations and capacities, are listed in table 2. The Bulembu asbestos mine, the Dvokolwako diamond mine, and the Ngwenge iron ore mine remained closed in 2006 (Mbendi, 2006a).

Outlook

The outlook for Swaziland's mineral industry is for little change in the near future. The low level of exploration was likely to constrain increases in production.

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TABLE 1
LESOTHO AND SWAZILAND: PRODUCTION OF MINERAL COMMODITIES[1]

Country and commodity		2002	2003	2004[e]	2005[e]	2006[e]
LESOTHO[2]						
Fire clay	cubic meters	42,000	14,470	15,000	15,000	15,000
Diamond	carats	721	2,099	14,000	37,000	37,000
Stone, quarry products:						
Dimension stone	square meters	29,766	1,089	1,000	1,000	1,000
Gravel and crushed rock	cubic meters	261,037	389,695	300,000	300,000	300,000
SWAZILAND[3]						
Coal, anthracite	metric tons	553,422	448,664	488,314 [4]	222,000	311,000
Ferrovanadium	do.	--	1,011	1,150	345	491
Stone, quarry products	cubic meters	283,175	324,129	230,062 [4]	567,000	534,688 [4]

[e]Estimated; estimated data are rounded to no more than three significant digits. -- Zero.
[1]Includes data available through September 1, 2007.
[2]Reported data from Lesotho Department of Mines and Geology for the financial year ending in April of the year shown for 2002 and 2003.
[3]In addition to the commodities listed, modest quantities of crude construction materials (brick clay and sand and gravel), kaolin, pyrophyllite (talc), and soapstone are produced, but output is not reported quantitatively, and information is inadequate to make estimates of output.
[4]Reported.

TABLE 2
LESOTHO AND SWAZILAND: STRUCTURE OF THE MINERAL INDUSTRIES IN 2006

(Metric tons unless otherwise specified)

Country and commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
LESOTHO				
Diamond	carats	Gem Diamond Mining Co. Ltd., 76%, and Government, 24%	Letseng Mine	36,000
SWAZILAND				
Coal		Maloma Colliery Ltd.	Maloma Mine at Maloma	888,000
Ferrovanadium		Swazi Vanadium (Pty) Ltd.	Maloma	2,400

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THE MINERAL INDUSTRIES OF LIBERIA AND SIERRA LEONE

By Omayra Bermúdez-Lugo

LIBERIA

The Republic of Liberia continued to recover from a 14-year-long civil war, which began in 1989 and brought the country's political system and economic sector to a standstill. Prior to the civil war, the Liberian economy had relied heavily on exports of iron ore, which ranged between 12 million metric tons per year (Mt/yr) and 24 Mt/yr during the period from 1964 to 1989. In 2006, the only mineral commodities being produced in the country were cement, crushed stone, diamond, gold, and sand. Diamond exports, however, continued to be under United Nations sanctions. In December 2006, the United Nations Security Council announced that Liberia had made insufficient progress to end the sanctions against it and therefore renewed the ban on diamond exports for an additional 6 months. The Security Council was to review the measure after 4 months to allow the Government time to establish an effective certificate of origin regime for the trade in rough diamond that would be transparent and internationally verifiable, with a view to joining the Kimberley Process Certification Scheme (United Nations Security Council, 2006).

Minerals in National Economy

A new Government was elected in Liberia at the end of 2005 and the new administration was ratified in January 2006. One of the first tasks undertaken by the new Administration to revamp the mining industry was the reviewing of all mining contracts in the country in an effort to comply with extractive industry international standards. The Government's plan was to revise all mining contracts signed by the National Transitional Government of Liberia (NTGL). The NTGL was Liberia's legislative body during the country's transition from civil war to democratic rule and its primary responsibility at the end of the war was, among other things, to implement the peace treaty and to prepare the country for national elections (Mining Journal, 2006b). According to a report by the Congressional Research Service, although the NTGL carried out most of its basic functions, the restoration of state authority and the rehabilitation of state institutions under its authority were hampered by central Government ministry inefficiencies, resource constraints, lack of institutional and financial system capacities, and lack of trained manpower. National budget and fiscal obligation mechanisms and voucher record-keeping systems under the NTGL were reportedly, in some instances, inefficient and subject to manipulation by key officials. One of the main issues that drew attention to the NTGL administration was natural resource and land-concession contract deals signed during its tenure. Among these contested contracts was the one signed with Mittal Steel Company N.V., which provided for the mining of iron ore in the northern part of the country and the rehabilitation of mining-related and transport infrastructure. The contract signed under the NTGL administration was to give Mittal a variety of rights, including surface rental, mining license, and transport infrastructure construction. These rights were granted in exchange for an investment of $900 million, in addition to royalties, taxes, and other payments to the Government. The contract drew criticism from civil society groups that believed the award of such a long-term contract should be carried out only by a duly elected Government. The renegotiated Mittal contract was under review by the Government in 2006. The terms of the new contract included provisions requiring iron ore prices to be set by the market and not by Mittal; a limited 5-year tax holiday instead of an indefinitely extendable one; Government control over the Port of Buchanan and the railway to Yekepa; recognition of Mittal's responsibility for liabilities faced by its operating affiliate in Liberia; and increased balance between the rights of existing property holders and the company regarding Mittal's right to expropriate new concession land (Cook, 2007, p. 22-27).

In 2006, Liberia became a candidate country to join the Extractive Industries Transparency Initiative (EITI), which is a voluntary global compact for improving transparency in countries that are dependent on extractive industries (Extractive Industries Transparency Initiative, 2006).

Production

According to the Central Bank of Liberia, the mining sector recorded no growth during 2006 compared with a decline of 14.9% in 2005. The low level of performance of the mining sector was attributed to unrecorded cross-border trade and to the diamond sanctions imposed by the United Nations (Central Bank of Sierra Leone, 2007, p. 35). The Ministry of Lands, Mines, and Energy was the Government agency responsible for the administration of the mining sector, which was regulated by the New Minerals and Mining Law of 2000. Data on mineral production are provided in table 1.

Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities.

Commodity Review

Metals

Gold.—Canada-based Mano River Resources Inc. (MRR), through its wholly-owned subsidiary Bea Mountain Mining Corp., signed a $700,000 contract with MODEM Engineering (MODEM) of Johannesburg for the preparation of a bankable feasibility study for the New Liberty Gold Mine (NLG) deposit

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(formerly King George Larjor deposit; name changed in 2006) and for the Weaju gold deposit in western Liberia, each of which were to be developed initially as open pit operations. The New Liberty Gold Mine deposit is an Archaen shear zone deposit, which is located about 90 kilometers (km) from Monrovia. Total measured and indicated mineral resources at NLG were estimated to be about 13.5 million metric tons (Mt) of ore at a grade of 3.18 grams per ton (g/t) gold. The mineral resource estimate was completed by Lower Quartile Solutions of South Africa (Mano River Resources Inc. 2006a, d).

Iron Ore.—The renegotiated Mining Development Agreement between Mittal Steel Company N.V. and the Government to mine the western iron ore deposits in Nimba County was signed and approved by the new Administration in December 2006 and was awaiting ratification by the National Legislature (Ministry of Lands, Mines, and Energy, 2007, p. 6-9). In 2005, Mittal Steel had entered into a Mining Development Agreement with the Government for the mining of about 1 billion metric tons of iron ore reserves in Nimba County. The contract, which was for 25 years, included the rehabilitation of the Buchanan Port and of the 267-km rail line to the old Yekepa Mine, which was closed during the 1990s owing to the civil war. Mittal did not plan to resume mining at Yekepa, although it did plan to reuse some of the remaining infrastructure at the mine. The first mining activities will take place instead at an abandoned mine in Tokadeh. The ore of the Tokadeh deposit was reportedly hematite ore with 45% to 55% iron content. The ore was to be processed as sinter feed instead of as lump or pellet. Mittal had an office in Monrovia with about 50 to 60 people and another in the Port of Buchanan with another 20 to 30 people. About 20,000 to 25,000 metric tons (t) of iron ore, which was owned by the Government, remained at the Port of Buchanan. The Government had put the ore up for tender and Mittal was awaiting its removal to begin the rehabilitation of the port. The rail line to Yekepa would be a single track operation with a capacity of 15 Mt/yr. Mittal's investment in the project will be about $1 billion (Mittal Steel Company N.V., 2005; Metal Bulletin, 2006; Mining Journal, 2006a).

The Government planned to put up for tender the Western Iron Ore Cluster, which consisted of the remaining iron ore reserves at Kongo, the Western Bomi Hills, and the Bea Mountains, and it planned to rehabilitate the remaining iron ore reserves at the Bong Mines (Ministry of Lands, Mines, and Energy, 2007, p. 6-9). In December 2006, Cotton & Western Mining Inc. issued a letter of acceptance as the technical managing partner to Kkaf Nigeria Ltd. (KNL) for the redevelopment of the Bong Mine. KNL was granted a 25-year mining license to rebuild and reopen the mine, which was abandoned in 1990. The cost of the project was estimated to be about $800 million. The overall responsibilities and share of the project had not been finalized at yearend but the first order of business was to arrange the sale and export of 300,000 t of direct-reduced iron (DRI) pellets that had been stockpiled at the mine since its closure (BNet.com, 2006).

MRR held a 3-year exploration license for an area of 425 square kilometers (km^2) centered on the Putu iron ore prospect in Grand Gedeh County, eastern Liberia. In the 1950s and 1960s, Liberian-American-Swedish Mining Company and Bong Mining Company had reviewed the Putu prospect and concluded that the prospect might potentially contain 500 Mt of iron ore with a 60% iron content. MRR planned to continue with its exploration program for Putu, which included in its first phase further geologic mapping and surface data collection and sampling and in its second phase, diamond drilling of mineralized zones (Mano River Resources Inc., 2006c).

Industrial Minerals

Diamond.—According to the Ministry of Lands, Mines, and Energy, exploration for kimberlites has been ongoing in Liberia since 1999, although intermittently, owing to the civil war. Exploration activities have concentrated in the western side of the country and in the Nimba County. The Government expected to make more acreages available for mineral exploration as companies relinquish portions of their concessions in line with the terms of their exploration agreements (Ministry of Lands, Mines, and Energy, 2007, p. 14-15).

MRR was among the companies exploring for diamond in western Liberia in joint venture with Trans Hex Group Limited (Trans Hex) of South Africa. In January, the MRR announced that kimberlite pipe K007 had proven to be diamondiferous. The company based its conclusion on the discovery of a single 0.4-carat diamond, which was obtained after processing a 600-kilogram (kg) sample of decomposed kimberlite. Following this discovery, the company began a drilling campaign to delineate pipes K001, K002, K003, and K007 at depth and to collect and process about 3 to 5 t of kimberlite. In May, MMR reported the discovery of six kimberlite pipes, five of which were reportedly diamondiferous. By July, the company had drilled pipes K001 and K003 and planned to drill pipe K002. The company announced the results of independent test work on a 74.82-kg sample collected from pipe K004, which yielded 57 diamonds weighing in total 0.035 carats. Based on these results, the company planned to conduct a drilling and surface bulk-sampling program to establish the macro-diamond grade and value of the pipes. Trans Hex was to ship a 5-metric-ton-per-hour dense media separation plant to Liberia to process bulk samples (Mano River Resource Inc., 2006b, e, f).

MMR in joint venture with African Aura Resources Limited (AAR) continued to explore for diamond throughout the year. A total of 80 stream samples were collected and processed in an area covering 400 km in western Liberia. MRR announced that many of the samples yielded abundant kimberlitic ilmenite with supporting garnet and chromite in at least five discrete areas within their exploration property. Followup work was to continue at one high-priority target area, which attracted 25,000 artisanal miners during the 1970s (Mano River Resources, 2006g).

Outlook

The country's lack of sufficient progress in its attempt to have the ban on diamond exports imposed by United Nations sanctions lifted continues to hinder Liberia's mining activities. The Government's plan to revise all mining contracts in the country in order to comply with extractive industry international

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standards and the fact that Liberia was being considered as a candidate country to join the EITI, however, suggest that the country is on its way to reestablishing self-governance and a transparent investment climate, which is likely to attract foreign direct investment in the mineral sector. If plans to redevelop the country's iron ore resources and to develop its diamond and gold resources come to fruition, the mineral sector is likely to become one of the main sources of foreign exchange and of employment in Liberia in the near future.

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SIERRA LEONE

Diamond was the most significant mineral commodity to the Republic of Sierra Leone. In the past, the mineral industry had generated from 15% to 18% of the country's gross domestic product (GDP) and 90% of export earnings, and employed about 250,000 people before the forces of the Revolutionary United Front disrupted diamond mining operations in 1992. Other mineral commodities produced in the country included bauxite, cement, gold, gypsum, ilmenite, and rutile. Before the start of the civil war, the Sierra Rutile Mine was one of the world's leading producers of ilmenite and rutile; bauxite and rutile operations, however, also closed in late 1994 and early 1995, respectively, as a consequence of the war.

In 2006, the country continued to recover from years of civil unrest. Real GDP growth was estimated to be 7.8% compared with 7.3% in 2005. Exports earnings in 2006 increased by about 39% reaching nearly $221 million from about $159 million in 2005, mostly owing to the resumption of bauxite and rutile mining (Bank of Sierra Leone, 2007, p. 1-3, 8-10, 2-26). The mining sector is regulated by the Mines and Minerals Act of 1996. The Law Reform Commission was in the process of revising the Act and expected to complete the work by the end of 2007 (Mining Journal, 2006, p. 8).

The Government and the African Development Bank, in conjunction with the United Kingdom Department for International Development, the European Union, and the World Bank, signed the Improved Governance and Accountability Pact, which was aimed at streamlining the conditions under which the country was to receive direct budgetary support. Disbursements for budgetary support, mainly from these institutions, totaled $61.52 million in 2006; an additional $13.61 million was disbursed by the International Monetary Fund in support of the Government's 2006-2008 Economic Recovery Program. The African Development Bank also approved a $4.3 million grant to strengthen the public financial management and energy sectors. An amendment to the National Power Authority Act removed the National Power Authority monopoly and allowed for the participation of the private sector in the provision of electricity (Bank of Sierra Leone, 2007, p. 1-3).

Minerals in the National Economy

The country's total value of exports in 2006 was $231 million, a 45% increase from that of 2005. Export earnings from the mineral subsector, which comprised bauxite, diamond, gold, ilmenite, and rutile, amounted to $179 million. Diamond accounted for about 70% of mineral exports and for about 54% of the country's total export earnings. A total of 582,300 carats was exported, of which 374,000 carats, or 64%, was gem quality and 208,300 carats, or 36%, was industrial quality (Bank of Sierra Leone, 2007, p. 25). Bauxite and rutile together accounted for about 29% of mineral export earnings and 22.5% of total export earnings. A total of 970,650 t of bauxite, 70,360 t of rutile, and 8,560 t of ilmenite worth $23.57 million, $28.5 million, and $1.06 million, respectively, was exported during the year (Bank of Sierra Leone, 2007, p. 25-27).

Production

Production of bauxite, ilmenite, and rutile was resumed in 2006. Bauxite output was 1.072 Mt, which was a 46% increase from the level of production in 1994. The Bank of Sierra Leone

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(2007, p. 9) reported that there were indications of a decline in alluvial diamond deposits, which led to a drop in artisanal mining in 2006. Production of cement increased by about 36% to 234,440 t from the 172,120 t produced in 2005, mostly owing to an increase in construction and rehabilitation activities, and to the installation of a new production plant in 2005. Diamond production decreased by about 9.7% to 603,566 carats from the 668,710 carats produced in 2005. A total of 582,330 carats with a value of $125 million was exported in 2006; of this amount, 16,820 carats was reportedly from kimberlite mining. Gold output increased by about 34% to 71 kg from 53 kg produced in 2005. The increase in gold output was attributed to an increase in gold mining activities related to favorable world market prices.

Structure of the Mineral Industry

The mining sector in Sierra Leone is regulated by the Mines and Minerals Amendment Act of 1994 and by the Mines and Minerals Amendment Act of 2003. The Petroleum Act of 2001 regulates petroleum activities. In 2003, a new "Core Mineral Policy" that was designed to revive the mining sector was established by the Ministry of Mineral Resources (MMR). The MMR is responsible for the administration of the mineral industry, the issuance of mining licenses, field monitoring, enforcement, and the maintenance of mining records. The Gold and Diamond Department (GDD) of the National Revenue Authority is responsible for implementing Sierra Leone's participation in and compliance with the international diamond trade control requirements of the Kimberley Process Certification Scheme. The GDD values and levies export taxes on all diamond that is exported through official channels from Sierra Leone. The GDD had a staff of eleven, all of whom were Sierra Leone nationals, and earns 0.75% of the 3% export tax on diamond; an independent diamond valuation firm earns 0.4%. The Mines Department monitors and regulates the mining and marketing of precious minerals and the Geological Survey Division issues prospecting licenses and monitors the activities of exploration companies across the country. Both of these departments are under the Ministry of Mineral Resources (Mining Journal, 2006, p. 5-6).

The diamond sector is dominated by two foreign companies—Koidu Holdings Ltd. of South Africa and the Bermuda-based Sierra Leone Diamond Company, which had several subsidiaries in the country, including Fatkad Mining Company Limited, Kangaroo Mining Company Limited, and Molans Mining Company Limited (Mining Journal, 2006, p. 10-11). According to Partnership Africa Canada, a nongovernmental organization, there were nine major exporters of diamond from Sierra Leone and about 80 people or companies that served as agents for these exporters. The cost of an exporting license was $40,000 per year and that of the agent was $25,000 per year (Mining Journal, 2006, p. 9).

The number of mining licenses in the country increased to about 2,400 in 2006 from less than 100 licenses granted in 2002. About 70% of these licenses were for the Kono District and the Tongo diamond fields (Diamonds and Human Security Project, The, 2006, p. 1, 5). Among the companies exploring for minerals in the country were African Diamond plc of Ireland; Cluff Gold Mining plc, through Cluff Gold UK Ltd. and Cluff Gold (SL) Ltd.; London-based Target Resources plc, through its subsidiary Milestone Trading Ltd.; Sierra Leone-based Sierra Leone Diamond Co. Exploration Ltd., which explored for primary diamond resources; African Diamonds plc, which held one exploration diamond license and two exclusive diamond prospecting licenses; and London-based Koidu Holdings Ltd., which was a joint venture of Energem Resources Inc. of Canada (40%), Switzerland-based Magma Diamond Resources Ltd. (35%), and Guernsey-based BSG Resources Ltd. (25%).

Commodity Review

Metals

Bauxite and Alumina.—Production at the SML bauxite mine was resumed in January 2006 after 10 years of being idle. Titanium Resources Group Ltd. (TRG), through Sierra Mineral Holdings Ltd. (SMHL), is the company that took over the production of bauxite in the country. The mine had closed in 1995 when members of the Revolutionary United Front vandalized the plants and equipment of the Sierra Rutile Limited and Sierra Leone Ore and Metal companies. Production of bauxite reached 1.07 Mt during the year. Bauxite reserves were estimated to be 12.4 Mt; the mine's nameplate capacity was 1.2 Mt/yr of bauxite. First bauxite production was shipped from the Nitti Port in February 2006. Full production was to be sold to Alcoa World Alumina LLC of the United States and Glencore AG (a subsidiary of Glencore International AG) of Switzerland under long-term sales contracts signed in 2005. The SML Mine is located in southwestern Sierra Leone about 150 km southeast of Freetown. SMHL's mining license was for a period of 10 years (Titanium Resources Group Ltd., 2006a, b; 2007, p. 6, 8-10).

Moydow Mines International Inc. of Canada and Luxembourg-based Gondwana Investments S.A. each held a 50% interest in the Porto Loko bauxite exploration project. In December 2006, the companies announced that they had agreed to grant TRG the right to acquire a one-third interest in the project by submitting a bankable feasibility study by December 31, 2007, and investing $2.5 million. The joint venture, however, was in the process of renewing its exploration license for Porto Loko, which expired at the end of 2006, and was pending Government approval to continue with exploration activities. Previous exploration on the property had reportedly outlined a resource of about 100 Mt of bauxite at an average grade of 47% Al_2O_3 (Moydow Mines International Inc., 2007, p. 4, 8).

Gold.—Gold in Sierra Leone is associated with greenstone belts and occurs in the Kangari Hills, the Sula Mountains, and in the Bo, Koinadougu, and Tonkolili Districts. Cluff Gold plc in joint venture with Winston Mines Limited completed 13,600 meters (m) of core drilling on three zones within the southern sector of the Baomahun gold prospect. The completion of the core drilling enabled SRK Consulting to complete an updated resource estimate for the Baomahun prospect. SRK's updated mineral resource estimate for Baomahun was 8.65 Mt at an

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average grade of 3.16 g/t gold. The joint venture planned to further conduct a 30,000-m drilling program during 2007. The Baomahun gold prospect is located in Sierra Leone's Southern Province about 180 km east of Freetown (Cluff Gold plc, 2007, p. 6).

Axmin Inc. held exploration permits for the Nimini Hills, the Gori Hills, the Makong, the Matotaka, and the Sokoya properties. In 2006, the company reported a resource estimate for the Komahun gold prospect located within the Nimini Hill property. The resource estimate, which was prepared by SRK, yielded an inferred mineral resource of 4.87 Mt at a grade of 2.5 g/t gold. The company planned to continue with its exploration program for all its properties in Sierra Leone through 2007 (Axmin Inc., 2007, p. 3).

Other companies exploring for gold in the country included London-based Target Resources plc, through its subsidiary Milestone Trading Ltd.; Vancouver-based Mano River Resources Inc. (MRR) in joint venture with Golden Star Resources Ltd. (GSR) of the United States, which explored for gold at the Nimini, the Pampana, and the Sonfon properties; and African Diamond plc of the United Kingdom, which held a mining license for the reworking of tailings from an old alluvial mining operation for which initial sampling had shown the presence of both gold and platinum-group metals (PGM) reportedly containing 0.24 to 0.57 g/t gold and 0.01 g/t PGM (Mining Journal, 2006, p. 4, 8).

Platinum-Group Metals.—Ambrian Capital plc of the United Kingdom through its wholly owned subsidiary Golden Prospect Mining Company Limited (Bermuda) explored for PGM at the York platinum deposit in joint venture with Jubilee Platinum plc of the United Kingdom. The York deposit is located in the village of York about 37 km south of Freetown. A geologic reconnaissance program for the property had been completed as of November 2006 (Ambrian Capital plc, 2006).

Titanium and Zirconium.—The Sierra Rutile Mine was reopened during the first quarter of 2006 by TRG. The company commissioned its first dredge in January and in May announced that it had made its first shipment of 7,000 t of rutile. TRG planned to commission a second dredge during the third quarter of 2007, which would produce an additional 100,000 t/yr, and a third dredge in 2008, which would add another 40,000 t/yr of rutile. Dredge D1 had a production capacity of 100,000 t/yr (Titanium Resources Group Ltd., 2006b, d; 2007, p. 4, 8-9). Offtake agreements were signed for about 80% of annual rutile production; ilmenite was produced as a byproduct (Industrial Minerals, 2006b). Ilmenite and rutile output did not reach 1994 production levels, yielding 13,819 t and 73,802 t, respectively, in 2006 compared with 47,000 t and 137,000 t, respectively, in 1994.

TRG also signed an agreement with Gondwana (Investments) S.A. to acquire the rights to the Rotifunk mineral sands deposit at a cost of $120,000 subject to due diligence. The Rotifunk prospect is reportedly the second ranked mineral sands deposit known in Sierra Leone and is located 45 km northwest of the Sierra Rutile Mine and 65 km southeast of Freetown. Identified mineral resources were estimated to be 170 Mt at a grade of 0.7% rutile, 0.84% ilmenite, and 0.06% zircon (Titanium Resources Group Ltd., 2006c; Industrial Minerals, 2006a, b).

Industrial Minerals

Diamond.—Sierra Leone's diamond production is mainly from alluvial mining, the majority of which has come from the Bo, the Kenema, and the Kono Districts along the drainages of the Bafi, the Mano, the Moa, the Sewa, and the Woa Rivers. Artisanal diamond mining, which has occurred since the 1930s, reached its peak during the late 1960s when production reached about 2 million carats per year. According to Kimberley Process Certification Scheme statistics, diamond production was 603,566 carats in 2006, which was about a 72% increase from the 351,860 carats produced in 2002. Reportedly, large areas of potentially diamondiferous gravel still remain unprocessed in the country owing to thick overburden cover that impedes manual operations. Kimberlites known to exist in the Koidu area and at Tongo and other areas, such as Kamaranka-Kamkwei and Kambia, are thought to host kimberlitic source rocks. The country's sole active kimberlite mining operation was owned by London-based Koidu Holdings Ltd., which was a joint venture of Energem Resources Inc. (40%), Magma Diamond Resources Ltd. (35%), and BSG Resources Ltd (25%) (Mining Journal, 2006, p. 8-9).

Partnership Africa Canada (a nongovernmental organization) reported that Sierra Leone's historical problem, in terms of managing and controlling the diamond industry in the past, is that diamond in the country is largely alluvial in nature, it has a very high unit value, and it is easy to mine. These factors made diamond mining attractive to criminals and smugglers and helped establish a warlord economy in the country between 1992 and 2002 when the Revolutionary United Front rebel group captured the diamond fields of the Kono District. Government revenue from artisanal diamond mining comes mainly from mining, dealer, and export licenses and from a 3% tax on exports (Diamonds and Human Security Project, The, 2006, p. 1). The loss of revenue from the unrecorded trade in diamond is unknown; however, the value of diamond exports in 2006, as reported by the Bank of Sierra Leone, was $125 million, which was about one-third of the $400 million that the Peace Diamond Alliance (a Sierra Leone-based nongovernmental organization) estimated the country's current value of diamond production per year to be.

Other companies exploring for diamond in the country included Canada-based Cream Minerals Ltd., Mano River Resources Inc., and Sierra Gold Corporation, and United Kingdom-based African Diamonds plc, River Diamonds plc, and Target Resources plc.

Mineral Fuels

Petroleum.—Sierra Leone did not produce or refine petroleum and was dependent upon imports for its petroleum requirements. Through an international tender held in 2003, the Government awarded Repsol YPF S.A. of Spain, in joint venture with Woodside Petroleum Ltd. of Australia, exploration licenses for offshore Blocks SL-6 and SL-7. The joint venture was in the process of interpreting three-dimensional seismic data for its exploration properties in 2006 (Woodside Petroleum Ltd., 2007).

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Outlook

Sierra Leone's economy is likely to continue to depend greatly on revenues from the diamond industry in the short run. In the longer run, however, rutile production, which was Sierra Leone's top export commodity during the early 1990s, could also contribute significantly to future earnings. Plans to increase rutile production capacity at the Sierra Rutile Mine by an additional 140,000 t/yr will likely place Sierra Leone among the world's leading producers of rutile after Australia and South Africa if such production were to come online in 2008. The country is also likely to benefit in the near future from expected increases in global bauxite demand, given that the country's bauxite is used as a process "sweetener" in the industry owing to its low digestion temperature (145°-150°C), which makes it more economical to process by major alumina refineries.

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TABLE 1
LIBERIA AND SIERRA LEONE: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2002	2003	2004	2005	2006
LIBERIA						
Cement, hydraulic		53,622	25,000 e	121,059 r	143,847 r	154,990
Diamond[5]	carats	80,000	40,000	10,000	NA r, 2	NA
Gold[5]	kilograms	42	20	110 3, 4	27 r	11
Sand		NA	NA	213,892 3, 4	222,274 4	220,000 e
Stone, crushed		NA	NA	NA	5,964 4	6,000 e
SIERRA LEONE						
Bauxite	thousand metric tons	--	--	--	--	1,072
Cement		144,145	169,109	180,460	172,120 r	234,440
Diamond[5]	carats	351,860 6	506,819 6	691,757 r, 7	668,710 7	603,566 7
Gold	kilograms	1 r	6 r	27	53	71
Gypsum[5]		4,000	4,000	-- 3	-- 3	--
Ilmenite		--	--	--	--	13,819
Rutile		--	--	--	--	73,802
Salt		1,821	1,005	827	--	--

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised. NA Not available. -- Zero.

[1]Table includes data available through October 2007.

[2]Export of diamond under United Nations Security Council sanctions.

[3]Reported figure.

[4]Source: Ministry of Lands, Mines, and Energy of Liberia.

[5]About 60% gem quality and 40% industrial quality.

[6]Exports.

[7]Kimberley Process Certification Scheme.

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TABLE 2
LIBERIA AND SIERRA LEONE: STRUCTURE OF THE MINERAL INDUSTRIES IN 2006

(Thousand metric tons unless otherwise specified)

Country and commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
LIBERIA				
Diamond		Artisanal miners	Throughout the country	NA
Gold		Mano River Resources	New Liberty gold deposit (under bankable feasibility study)	NA
Iron ore		Mittal Steel Company N.V.	Tokadeh iron ore deposit (Awaiting Government approval to begin mining)	NA
SIERRA LEONE				
Bauxite		Sierra Mineral Holdings I Ltd. (Titanium Resources Group Ltd.)	SML Mine, 150 kilometers southeast of Freetown	1,200
Cement		Sierra Leone Cement Corp. Ltd.	Freetown plant	NA
Diamond	carats	Koidu Holdings Ltd. (Energem Resources Inc., 40%, and BSG Resources Ltd., 25%)	Two kimberlite pipes, Koidu	120
Ilmenite		Sierra Rutile Ltd. (Titanium Field Resources Ltd. and U.S. Titanium, LLC)	Sierra Rutile Mine	15
Titanium, rutile concentrate		do.	do.	100 [1]

NA Not available.
[1]Production capacity is expected to increase to 200,000 metric tons per year (t/yr) in 2007 and 240,000 t/yr in 2008.

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The Mineral Industry of Libya

By Philip M. Mobbs

The hydrocarbon sector, primarily the production of crude oil, dominated Libya's economy. The Government was attempting to diversify the state-controlled economy, but natural gas and petroleum operations continued to account for more than 95% of export revenues, about 93% of Government revenue, and about 28% of the real gross domestic product. The hydrocarbon sector, especially petroleum exploration and downstream oil processing operations, continued to recover from the adverse impact of international sanctions, most of which were rescinded in 2003 and 2004 (Elhage and others, 2007, p. 3, 13, 26).

Libya's oil reserves accounted for about 3% of worldwide reserves and ranked the country eighth. Libya was Africa's third ranked oil producer and produced about 2% of the world's crude oil, which ranked the country 15th internationally. Most of the produced oil was exported to Europe (BP p.l.c., 2007, p. 6, 8).

Petroleum law No. 25 of 1955, the Petroleum Regulations amendments, and the provisions of Exploration and Production-Sharing Agreement IV governed the hydrocarbon sector. In early 2006, many of the functions of the Ministry of Energy were transferred to the Ministry of Industry and Minerals. The combined organization was renamed the Ministry of Industry, Electricity, and Mines. The responsibility for the regulation of natural gas and oil projects in the hydrocarbon sector was transferred temporarily to the National Oil Corporation (NOC). In September, the Government formed the Council for Oil and Gas Affairs to manage the hydrocarbon industry.

Production

In addition to hydrocarbons, other Libyan mineral and mineral-based commodity production included ammonia, cement, clay, direct-reduced and hot-briquetted iron, gypsum, lime, methanol, salt, sand, steel, stone, sulfur, and urea. In the future, cement and natural gas production was expected to increase because of the ongoing installation of new cement kilns and the necessary infrastructure to capture oilfield-associated natural gas. Production from newly discovered oilfields was expected to offset the natural decline in production from older reservoirs.

Structure of the Mineral Industry

The implementation of the Government's proposed transformation to an open-market economy from a centrally planned system had proved unpopular. Therefore, the Government proceeded with divestment of its interest in formerly state-controlled companies cautiously. Libya's major mineral operations, such as iron and steel, natural gas, and petroleum, remained state-owned, although Ispat Industries Ltd. of India managed the Libyan Iron and Steel Co. under a partnership agreement and international oil companies operated in Libya under production-sharing agreements.

Most natural gas production in Libya was associated with crude oil production. To meet the increased domestic and international demand, the state-owned NOC actively promoted exploration for natural gas while maintaining its traditional focus on crude oil.

Commodity Review

Metals

Iron and Steel.—In 2006, work continued on the addition of three electric arc furnaces (EAFs) and a ladle furnace to the Libyan Iron and Steel Co. plant at Misurata. The installation of the EAFs in Steel Melt Shop no. 1 was expected to increase the facility's capacity to 1.1 million metric tons per year (Mt/yr) from 630,000 metric tons per year (t/yr) (Libyan Iron and Steel Co., 2006; Techint Group, The, 2006, p. 20).

The Federal and regional governments promoted the development of the Wadi ash Shati iron ore deposit, which was located about 530 kilometers from the coast. Past resource evaluations estimated that the deposit contained from 3 to 5 billion metric tons of ore that ranges in grade from 30% to 55% iron content (Goudarzi, 1970, p. 54-69; Turk, Doughri, and Banerjee, 1978, p. 1019).

Industrial Minerals

Cement.—Arab Cement Co. changed its name to Ahlia Cement Co. (AhCC) after the partial privatization of the company in 2005. AhCC planned to add a 1.8-Mt/yr-capacity cement line at the Lebda plant, to renovate the existing 1-Mt/yr-capacity line and add an 800,000-t/yr-capacity cement line at the Souk el Khamis plant, and to build a second 1-Mt/yr-capacity cement production line at its Zliten plant (PEG S.A., 2007, p. 4).

In 2005, Arab Union Contracting Co. (AUCC) began commercial production at its 1.4-Mt/yr-capacity cement clinker plant near Zliten. In 2006, AUCC proposed to add a 1.8-Mt/yr-capacity cement line to the new plant. Libyan Cement Co. (LCC) proposed to add a total of 2.4 Mt/yr of capacity to its plants at El Fataih and El Hawari. LCC also evaluated the construction of a 200,000-t/yr-capacity white cement plant at El Fataih (Middle East Economic Digest, 2006; United World Ltd., 2006).

Outlook

The hydrocarbon sector was expected to remain the focus of most of the foreign direct investment received by Libya, and the sector's revival was expected to continue with the assistance of international oil companies. The Government proposed a significant increase in national oil production, subject to production quotas imposed by the Organization of the Petroleum Exporting Countries.

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Production of industrial minerals, such as clays, gypsum, lime, and salt, are expected to continue to dominate Libya's solid minerals sector. Cement, nitrogenous fertilizer, iron, and steel are expected to continue to dominate the processed mineral commodity sector.

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TABLE 1
LIBYA: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004[e]	2005[e]	2006[e]
Cement, hydraulic[e]		3,300	3,500	3,600	3,621 [r]	3,600
Gas, natural:						
Gross	million cubic meters	13,100	14,000	14,900	15,000	17,000
Dry	do.	11,100	10,300	10,700	11,700	14,800
Gypsum[e]		150	150	175	175	175
Iron and steel, metal:						
Direct-reduced iron[3]		1,170	1,340	1,580 [4]	1,650 [4]	1,630 [4]
Crude steel		886	1,007	1,026 [4]	1,260 [4]	1,158 [4]
Lime[e]		250	250	250	250	250
Methanol		680	727	670	610	620
Nitrogen:						
N content of ammonia		533	577	577	580	520
N content of urea		400	425	425	425	400
Petroleum:						
Crude[e]	thousand 42-gallon barrels	502,000	543,000	587,000	630,000 [r]	660,000
Refinery products:						
Liquefied petroleum gas	do.	1,400	2,300	2,200	2,300	2,300
Gasoline	do.	6,100	7,300	5,600	6,000	6,000
Naphtha	do.	19,300	21,200	11,200	20,000	20,000
Kerosene and jet fuel	do.	11,800	12,400	20,300	12,500	12,500
Distillate fuel oil	do.	25,000	28,100	28,700	28,500	28,500
Residual fuel oil	do.	39,200	41,600	42,800	42,500	42,500
Total	do.	102,800	112,900	110,800	112,000	112,000
Salt[e]		40	40	40	40	40
Sulfur, byproduct of petroleum and natural gas[e]		15	15	15	16	16

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised.

[1]Table includes data available through August 13, 2007.

[2]In addition to the commodities listed, a variety of clay, dolomite, limestone, sand, and crushed construction stone was produced, and natron (soda ash) may have been produced, but available information is inadequate to make estimates of output. Natural gas liquids also were produced but were blended with crude petroleum and reported as part of that total.

[3]Includes hot-briquetted iron.

[4]Reported figure.

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TABLE 2
LIBYA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity
Cement		Libyan Cement Co.	Benghazi	1,500
Do.		Arab Union Contracting Co.	Zliten	1,400
Do.		Ahlia Cement Co.	Homs 2, Lebda	1,000
Do.		do.	Souk el Khamis, Tripoli	1,000
Do.		do.	Zliten	1,000
Do.		Libyan Cement Co.	El Fataih, Derna	1,000
Do.		do.	El Hawari	400
Do.		Ahlia Cement Co.	Homs 1, El Margueb	300
Iron and steel:				
Iron:				
Hot-briquetted iron		Libyan Iron and Steel Co. (Government)	Misurata	650
Sponge iron		do.	do.	1,100
Steel:				
Crude		do.	do.	1,250
Rolled:				
Bar and rod		do.	do.	800
Cold-rolled strip		do.	do.	140
Hot-rolled strip		do.	do.	580
Methanol		Sirte Oil Co. for Production and Processing of Oil and Gas (National Oil Co. of Libya)	Marsa el Brega	365
Natural gas, liquefied		do.	do.	700 [1]
Nitrogen:				
Ammonia		do.	do.	803
Urea		do.	do.	1,041
Petroleum:				
Crude	thousand 42-gallon barrels per day	National Oil Co. of Libya in joint ventures with or under production-sharing agreements with international oil companies; and subsidiary companies of National Oil Co. of Libya, which included Arabian Gulf Oil Co.and Sirte Oil Co. for Production and Processing of Oil and Gas	Cyrenaica, Ghadames, Murzuq, and Sirte basins and offshore	1,609
Refined	do.	Ras Lanuf Oil and Gas Processing Co. (National Oil Co. of Libya)	Ras Lanuf	220
Do.	do.	Az Zawiya Oil Refining Co. (National Oil Co. of Libya)	Az Zawiya	120
Do.	do.	Arabian Gulf Oil Co. (National Oil Co. of Libya)	Tobruk	20
Do.	do.	do.	Sarir	10
Do.	do.	National Oil Co. of Libya	Marsa el Brega	8

[1] Renovation planned.

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The Mineral Industry of Madagascar

By Thomas R. Yager

Madagascar played a significant role in the world's production of gemstones and graphite. In 2006, Madagascar was the world's top-ranked sapphire producer; the country's share of global graphite production amounted to about 1%. Other domestically significant minerals produced included chromite and ornamental stones. Madagascar was not a globally significant consumer of minerals in 2006 (Pardieu and Wise, 2006b; Olson, 2007).

Minerals in the National Economy

In 2006, the manufacturing sector accounted for 12.3% of the gross domestic product, and the mining and construction materials sector, 0.6%. The mining sector provided about 500,000 full-time and seasonal jobs that included more than 100,000 miners and traders at the Ilakaka sapphire mines, more than 15,000 at the Andilamena ruby mines, and tens of thousands at the Alatsinainy Ibity tourmaline deposit (Ministry of the Economy, Finance, and Budget, 2006, p. 110; Pardieu and Wise, 2006a, c; Rakotomalala, 2006b; Resource Information Unit, 2007).

Production

In recent years, the production of chromite, labradorite, and salt have increased sharply; sapphire production has declined. The petroleum refinery was shut down in 2004. The production of most mineral commodities was estimated to have remained unchanged in 2006. Data on mineral production are provided in table 1.

Structure of the Mineral Industry

Most of Madagascar's mining and mineral processing operations were privately owned, including the gemstone, graphite, and salt mines and the cement plant. Artisanal miners produced gemstones and gold. Ownership disputes between artisanal miners were reported at Ilakaka. State-owned Kraomita Malagasy (KRAOMA) was the country's only chromite producer (Pardieu and Wise, 2006c). Table 2 lists major mineral industry facilities in Madagascar.

Commodity Review

Metals

Bauxite and Alumina.—In November 2006, Alcan Inc. of Canada signed an agreement with Access Madagascar Sarl, which held the mineral rights for the Manantenina bauxite deposit in southeastern Madagascar. The companies planned to complete a concept study of the development of an alumina refinery with a capacity of between 1 and 1.5 million metric tons per year (Mt/yr) and of a bauxite mine in the second quarter of 2007. Alcan and Access Madagascar could engage in a feasibility study if the concept study yielded favorable results (King, 2006).

Chromium.—KRAOMA produced chromite concentrates and lumpy ore from its mines at Ankazotaolana and Bemanevika. The Bemanevika Mine opened in early 2006; reserves at the Ankazotaolana Mine were expected to be depleted in December. Production declined by 6% in 2006. Starting in 2007, KRAOMA planned to produce 200,000 metric tons per year (t/yr) of chromite at Bemanevika (Ministry of Energy and Mines, 2006, p. 18).

Cobalt and Nickel.—Starting in late 2009, Dynatec Corp. of Canada, Korea Resources Corp. of the Republic of Korea, and Sumitomo Corp. of Japan planned to mine two nickel-cobalt deposits at Ambatovy. Dynatec received an environmental permit for Ambatovy in December 2006; construction was expected to start at the beginning of 2007. Lateritic slurry from the ore-processing plant was to be processed at a pressure-acid-leaching plant at Toamasina. The plant was expected to produce a sulfide product that contained 55.2% nickel and 4.2% cobalt. The sulfide product would be processed at a refinery with a capacity of 60,000 t/yr of refined nickel and 5,600 t/yr of cobalt. Capital costs of the mine, pipeline, processing plants, refinery, power supply, and port facilities were estimated to be $2.25 billion (Mining Journal, 2005a, 2007).

At the end of 2006, Diamond Fields International Ltd. was finalizing the purchase of the mining rights for the Valozoro nickel laterite deposit in south-central Madagascar. Pan African Mining Corp. of Canada explored at its Nickel Valley property in northern Madagascar (Diamond Fields International Ltd., 2007; Pan African Mining Corp., 2007).

Copper and Platinum-Group Metals.—Jubilee Platinum plc of the United Kingdom explored at the Ambodilafa copper-gold-nickel, the Lanjanina copper-nickel, and the Londokomanana copper-nickel-platinum-group-metals properties. Jubilee and TransAsia Minerals Ltd. formed a joint venture in October 2006 to explore at Londokomanana; TransAsia agreed to spend $10 million on exploration during 3 years (Resource Information Unit, 2007).

Gold.—Golden Deeps Ltd. of Australia explored for gold at the Kelimaizina gold prospect in north-central Madagascar. In March 2006, Pan African completed the first phase of exploration at its Mountain of Gold property in west-central Madagascar; the company started the second phase in September (Resource Information Unit, 2007). Majescor Resources Inc. of Canada and Prom Resources Inc. of the United States also explored for gold.

Titanium and Zirconium.—Rio Tinto plc started construction at its mineral sands joint-venture project at Mandena in southeastern Madagascar [QIT Fer et Titane of Canada (a subsidiary of Rio Tinto), 80%; and the Government of Madagascar, 20%]. Production was expected to start in the third quarter of 2008; Rio Tinto planned to produce 750,000 t/yr of ilmenite by 2012. In future phases of the project, production could increase to 2 Mt/yr. The cost of the mine and processing

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facilities was estimated to be $440 million, and a new port at Ehola, $145 million (Mining Journal, 2005b; Ministry of Energy and Mines, 2006, p. 18).

Kumba Resources Ltd. of South Africa and Ticor Ltd. of Australia were engaged in a feasibility study on the Toliara mineral sands deposit. The companies planned to complete the study in early 2007 (Ministry of Energy and Mines, 2006, p. 18).

Industrial Minerals

Cement and Crushed Stone.—Holcim (Madagascar) S.A. was Madagascar's only cement producer (the plant operated by LaFarge Group at Mahanjanga was shut down in 2004). In 2006, the company produced at its full capacity of 150,000 t/yr; national cement consumption was about 500,000 t/yr. Holcim also produced limestone at a rate of about 260,000 t/yr in 2006. By February 2007, Holcim planned to increase capacity at the Ibity plant to 240,000 t/yr of cement (Rampanjato, 2005; Rakotomalala, 2006a).

Chine Shuguang Maloci of China planned to complete a new cement plant at Ambohimanambola by July 2007 that would produce 250,000 t/yr. The company planned to produce cement initially from imported clinker (Madagascar Tribune, 2006b).

Gemstones.—Madagascar was the world's leading producer of sapphire; most domestically mined sapphire was produced by artisanal miners at Ilakaka, Manombe, and Sakara in the south-central part of the country. Recent declines in production were attributable to the depletion of easily mined deposits near the surface at Ilakaka. In October 2005, the Marosely sapphire deposit was discovered south of Ranotsara; production from Marosely amounted to 500 kilograms by June 2006. Small amounts of sapphire were also produced at Ambondromihefy (Pardieu and Wise, 2006b, c; Pezzotta, 2006).

Mayfair Mining and Minerals Inc. of the United Kingdom acquired a 51% interest in Union Prospection Miniere (UPM) in May 2006 and a 100% interest in July. UPM held properties in the Ilakaka area that included the Benahy-Imaloto sapphire mine, which was operating in 2006. Mayfair planned a 3-year exploration program for these properties at an estimated cost of $1.05 million (Mayfair Mining and Minerals Inc., 2006).

In August and September 2005, several metric tons of mostly carving-quality multicolored tourmaline were found at Nandihizana. Other deposits were found south of this area, including the Ankitsikitsika, the Antsengy, and the Fiadanana deposits. In September 2006, tourmaline production increased at the Alatsinainy Ibity tourmaline deposit located near Antsirabe because of an increase in demand (Pezzotta, 2006; Rakotomalala, 2006b).

Ruby was mined near Andilamena in north-central Madagascar and at Vatomandry on the east coast. In March 2006, a new ruby deposit was reportedly discovered at Antanodava in central Madagascar. Emerald was mined at Mananjary near the east coast. A wide variety of ornamental stones that included agate, labradorite, and rose quartz were also produced.

Graphite.—In March 2006, Graphite Technology Group Inc. of the United States acquired a 50% share in Société Minière de la Grande Ile, which operated the Ambatomitamba Mine and four other graphite mines. Graphite Technology was purchased by BPK Resources Inc. of the United States in April, which changed its name to iCarbon Corp. (BPK Resources Inc., 2006). Etablissements Gallois was the country's leading graphite producer; Etablissements Izouard, Etablissements Rostaing, and Société Arséne Louys also mined graphite.

Salt.—Compagnie Salinière de Madagascar produced salt at Antsahampano in the northern part of the country. In 2006, Compagnie Salinière produced at its full capacity of 70,000 t/yr; the company planned to increase its capacity to 80,000 t/yr in 2010 (Taloumis, [2007]).

Mineral Fuels and Related Materials

Coal.—In August 2006, Pan African announced the conclusion of its first phase of study on the Sakamena and the Sakoa coalfields in southwestern Madagascar. The company planned further exploration (Pan African Mining Corp., 2007).

Petroleum.—Madagascar's only petroleum products refinery at Toamasina was shut down in August 2004 because of its small size and aging equipment. Galana Petroleum Ltd. announced plans to dismantle the refinery in June 2006 (Madagascar Tribune, 2006a).

Exxon Mobil Corp. and its joint-venture partners planned to drill a well at the Mahajanga offshore concession at a cost of $100 million. Madagascar Oil (a subsidiary of Vuna Energy Ltd. of the United Kingdom) planned exploration at the Tsimiroro bituminous sands deposit. Sterling Energy plc of the United Kingdom held the Ambilobe and the Ampasindva licenses, which were located to the north of Mahajanga (Mining Journal, 2007).

Uranium.—Pan African and the Government agency l'Office des Mines Nationales et des Industries Strategiques (OMNIS) had a joint-venture agreement to explore, develop, and mine uranium at Faratsiho, Folakara, Makay, and Tranomaro. Pan African explored at Tranomaro in 2006; further exploration was planned in 2007. Cline Mining Corp. of Canada formed a joint venture with OMNIS to explore in western Madagascar in February 2006. UMC Energy plc purchased Cline's 80% share of the joint venture in September and Cline received a 40% share in UMC Energy (Pan African Mining Corp., 2007; Resource Information Unit, 2007).

Outlook

Madagascar's mineral industry is likely to grow significantly with the startup of ilmenite, rutile, and zircon production in 2008, and cobalt and nickel production in 2009. The depletion of placer sapphire deposits at Ilakaka and changes in the mining code designed to encourage large-scale capital investment could lead to an increase in mechanized sapphire mining operations. Cement and chromite production are expected to increase in 2007 (Pardieu and Wise, 2006b).

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TABLE 1
MADAGASCAR: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Kilograms unless otherwise specified)

Commodity[3]		2002	2003	2004	2005	2006
METALS						
Beryllium, beryl in quartz concentrates, industrial and ornamental		1,000	1,000	1,000	1,000	1,000
Chromium, marketable output:						
Chromite concentrate, gross weight	metric tons	3,000 r	12,000	21,000	36,000 r	32,000
Chromite ore, lumpy	do.	8,000	33,000	56,000	105,000	100,000
Total	do.	11,000 r	45,040 e	77,386 e	140,847 r, e	132,335 e
Gold, mine output, Au content[5]		--	10 e	5 e, 6	5 e, 6	5
INDUSTRIAL MINERALS						
Abrasives, natural (industrial only)		NA r	NA r	NA r	NA r	NA
Cement, hydraulic	metric tons	30,000	200,000 r	170,000 r	150,000 r	150,000
Clay, kaolin	do.	170	170	170	170	170
Feldspar	do.	3	3	3	3	3
Gemstones:[7]						
Amethyst[8]		617 e, 6	620	620	620	620
Cordierite		158 e, 6	160	160	160	160
Emerald		31 e, 6	40	53 e, 6	60	60
Garnet		599 e, 6	600	600	600	600
Ruby		889 e, 6	800	741 e, 6	920	920
Sapphire		9,326 e, 6	6,000	5,890 e, 6	4,700	4,700
Tourmaline[8]		63,722 e, 6	64,000	64,000	68,000 r	68,000
Graphite, all grades	metric tons	2,000	15,000	15,000	15,000	15,000
Gypsum	do.	500	500	500	500	500
Mica, phlogopite	do.	90	90	90	90	90
Ornamental stones:[7]						
Agate		20,000	25,000	25,000	25,000	25,000
Labradorite	metric tons	4,183 e	5,500 r	6,200 r	6,200 r	6,200
Quartz	do.	423 e	430	430	430	430
Salt, marine[9]	do.	50,000 r	50,000 r	55,000 r	65,000 r	75,000
Stone:						
Dimension	do.	200	200	200	200	200
Limestone[10]	do.	50,000	290,000	260,000	260,000	260,000
Marble	do.	5,600	5,000	5,000	5,000	5,000
MINERAL FUELS AND RELATED MATERIALS						
Petroleum refinery products:						
Gasoline	thousand 42-gallon barrels	237	480 r	310 r	-- r, e	-- e
Kerosene and jet fuel	do.	163	330 r	210 r	-- r, e	-- e
Distillate fuel oil	do.	357	720 r	460 r	-- r, e	-- e
Residual fuel oil	do.	317	640 r	400 r	-- r, e	-- e
Liquefied petroleum gas	do.	14	30 r	20 r	-- r, e	-- e
Total	do.	1,088	2,200 r	1,400 r	-- r, e	-- e

NA Not available. rRevised. -- Zero.

[1]Estimated data are rounded to no more than three significant digits.

[2]Table includes data available through August 9, 2007.

[3]In addition to the commodities listed, modest quantities of crude construction materials (other clays, sand and gravel, and stone) and industrial calcite presumably are produced, but output was not reported quantitatively, and available information is inadequate to make reliable estimates of output.

[4]Reported figure.

[5]Does not include smuggled artisanal production, which is estimated to range from 1,000 to 2,000 kilograms per year.

[6]Reported exports.

[7]Does not include smuggled artisanal production.

[8]Includes both gem and ornamental quality.

[9]Compagnie Salinière de Madagascar and Grand Salins du Menabe only. Other companies reportedly produced small amounts of salt.

[10]Cement producers only.

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TABLE 2
MADAGASCAR: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity
Cement		Holcim (Madagascar) S.A. (Holcim Group, 90%)	Plant at Ibity	150,000.
Do.[1]		SA Nouvelle Cimenterie d'Amboanio (LaFarge Group, 66%, and Moustansir Ibaramdty family, 34%)	Plant at Mahajanga	50,000.[e]
Chromium		Kraomita Malagasy (Government, 100%)	Mine at Ankazotaolana	250,000.
Do.		do.	Mine at Bemanekiva	200,000.[e]
Gemstones:				
Rough:				
Emerald	kilograms	Artisanal and small-scale miners	Mines at Mananjary	60.[e]
Labradorite		Marbres et Granits de Madagascar	Mines at Ambatofinandrahana and Bekily	4,200.[e]
Ruby	kilograms	Artisanal and small-scale miners	Mines at Andilamena and Vatomandry	1,000.[e]
Sapphire	do.	do.	Mines at Ilakaka and Sakara	5,000.[e]
Polished[2]	do.	Dream Stones Trading	Plant in Antananarivo	15.
Graphite		Etablissements Gallois	Artsirakambo Mine near Brickaville	4,800.
Do.		do.	Marovinsty Mine near Vatomandry	3,600.
Do.		do.	Ambalafotaka Mine	NA.
Do.		Société Minière de la Grande Ile (Graphite Technology Group Inc., 50%)	Ambatomitamba Mine near Tamatave	6,000.
Do.		do.	Ambiani, Ambodihasina, Sandraka, and Sahamaloto Mines	3,600.
Do.		Société Arséne Louys	Mine at Ambatoharanana	3,000.[e]
Do.		Etablissements Izouard	Faliarno Mine near Moramanga	2,000.
Do.		Etablissements Rostaing	NA	NA.
Gypsum		Compagnie Salinière de Madagascar	NA	500.
Mica		Société des Mines d'Ampandrandava	Tolagnaro	2,000 processed.
Salt		Compagnie Salinière de Madagascar	Antsahampano	70,000.
Do.		Grand Salins du Menabe	Morondava	5,000.[e]

[e]Estimated. NA Not available.
[1]Shut down in 2004.
[2]Includes amethyst, aquamarine, emerald, sapphire, tourmaline, and other gemstones.

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THE MINERAL INDUSTRY OF MALAWI

By Thomas R. Yager

Malawi was a producer of cement, coal, crushed stone, dolomite, kaolin, lime, and limestone for domestic consumption. The country also produced and exported dimension stone and gemstones. Malawi was not a globally significant producer or consumer of minerals.

Production

In 2006, the reported production of gemstones and coal increased by 34% and 7%, respectively; cement production was estimated to have increased by 25%, and limestone production for use in the cement industry, by 22% (table 1). Lime output was estimated to have declined by 4% in 2006. The mining of ornamental stone was stopped in 2005.

Structure of the Mineral Industry

Most of the mining and mineral processing operations in Malawi were privately owned, including the cement plants, the Mchenga coal mine, and the Chimwadzulu Hill ruby and sapphire mine. Small-scale and artisanal miners produced crushed stone, gemstones, and lime (table 2).

Commodity Review

Metals

Gold, Nickel, and Platinum-Group Metals.—Lisungwe plc of the United Kingdom explored at the Chimwadzulu Hill property for nickel and platinum-group metals (PGM); the Choma Hill, for gold; and at the Likudzi, for gold and PGM. These properties are located in the Ntcheu District. Albidon Ltd. of Australia explored for nickel and PGM at its Mpemba project near Blantyre (Lisungwe plc, 2006).

Titanium and Zirconium and Hafnium.—Allied Procurement Agency and Mineral Sands Ltd. of South Africa started a pilot project for mining rutile and zircon at Chipoka Bay on the west side of Lake Chilwa in 2006. The companies planned to start large-scale mining by November 2007. Contained resources of zircon and rutile at Chipoka Bay amounted to 6.7 million metric tons (Mt) and 3.6 Mt, respectively. Garnet and ilmenite resources were not economic because of transportation costs (Malawi Nation, 2006; Industrial Minerals, 2007).

Millennium Mining Ltd. of Australia was considering the development of the Makanjila and the Salima Bay mineral sands deposits. The company planned to produce 500,000 metric tons per year (t/yr) of ilmenite from Makanjila and Salima, which would be smelted at Chipoka. Development of the smelter, which was expected to produce 250,000 t/yr of titanium slag, depended on Millennium's ability to obtain power supplies from Mozambique (Mining Review Africa, 2005).

Industrial Minerals

Cement.—Portland Cement Company Ltd. (a subsidiary of Lafarge S.A. of France) operated a cement plant with a capacity of 200,000 t/yr; the company's market share amounted to about 75% in 2006. Shayona Cement Corp. planned to increase its cement production to 110,000 t/yr from 37,000 t/yr in 2006; it is unclear whether the expansion actually took place (Malunga, 2006; Lafarge S.A., 2007, p. 29).

Rare-Earth Elements.—Rare Earths Company planned to produce at least 6,000 t/yr of rare-earth minerals from the Kangankunde deposit in central Malawi. In May 2005, the company suspended the project because of an inability to find joint-venture partners (Chimwala, 2005).

Mineral Fuels and Related Materials

Uranium.—Paladin Resources Ltd. of Australia was engaged in a bankable feasibility study of the Kayelekera uranium project in northern Malawi. The cost of the project was estimated to be about $130 million. Paladin planned to produce 1,000 t/yr of uranium oxide (U_3O_8) starting in mid-2008 if the feasibility study yields favorable results. Uranium could become Malawi's second ranked export if the project proceeds. Resources at Kayelekera were estimated to be 18.7 Mt at a grade of 0.08% uranium (Phiri, 2006; Resource Information Unit, 2007).

In December 2005, Red Rock Resources plc of the United Kingdom acquired the Chintheche and the Machinga properties, which are located on the western shore of Lake Malawi and north of Zomba, respectively. Red Rock planned to start exploration in 2007. In March 2006, Globe Uranium Ltd. of Australia acquired the Kanyika and the Livingstonia properties, which are located northeast of Kasungu and south of Chilumba, respectively. The company engaged in exploration in October (Resource Information Unit, 2007).

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TABLE 1
MALAWI: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004	2005[e]	2006[e]
Cement, hydraulic		109,300 [r]	161,000 [r]	119,500	160,000 [r]	200,000
Coal, bituminous		43,372	47,037	40,891	44,900 [r,3]	48,000 [3]
Dolomite[e]		4,394 [3]	5,400	5,400	5,400	5,400
Gemstones	kilograms	2,305	2,297	1,820	1,620 [r,3]	2,171 [3]
Kaolin[e]		636 [3]	800	800	800	800
Lime		6,776	18,877	23,095	22,000 [r]	21,147 [3]
Ornamental stone		120	450	320	20	--
Stone:						
Crushed for aggregate		113,992	159,954	168,600	170,000 [r]	170,000
Dimension, crude and partly worked		130	100 [e]	--	--	--
Limestone, for cement		86,234	23,965	21,224	28,000	34,226 [3]

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised. -- Zero.
[1]Table includes data available through November 15, 2007.
[2]In addition to commodities listed, modest quantities of gypsum and salt and unlisted varieties of crude construction materials (clays, and gravel and other stone) may also be produced, but information is inadequate to make reliable estimates of output.
[3]Reported figure.

TABLE 2
MALAWI: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Cement	Portland Cement Co. Ltd. (Lafarge S.A., 75.17%)	Plant at Blantyre	200,000.
Do.	Shayona Cement Corp.	Plant at Livwezi	37,000.
Coal, bituminous	Mchenga Coal Mines	Mine at Mchenga	60,000.
Dimension stone	Ilomba Granite of Blantyre[1]	Mine at Ilomba Hill	NA.
Fertilizer	Optichem Ltd.	Plant at Blantyre	40,000.
Limestone	Shayona Cement Corp.	Mine in Kasungu Province	NA.
Ruby and sapphire kilograms	Agricola Resources plc	Mine at Chimwadzulu Hill	420 sapphire[e]; 180 ruby.[e]

[e]Estimated. NA Not available.
[1]Not operating in 2006.

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The Mineral Industry of Mali

By Omayra Bermúdez-Lugo

Mali is a landlocked country in West Africa that is bordered by Algeria, Burkina Faso, Côte d'Ivoire, Guinea, Mauritania, Niger, and Senegal. In 2006, the population was about 12 million and was growing at an estimated rate of about 2.6% per year. The country's total land and water area is 1.24 million square kilometers (km^2) (U.S. Central Intelligence Agency, 2006).

Mali's mining sector was still underdeveloped even though several old and new gold mines have come into production in recent years. The country's vast undeveloped mineral resources included bauxite, chromium, copper, diamond, granite, gypsum, iron ore, kaolinite, lead, lithium, manganese, marble, nickel, niobium, palladium, phosphate rock, rutile, silver, talc, thorium, tin, titanium, tungsten, uranium, and zirconium (Direction Nationale de la Géologie et des Mines, 2006). Silver occurs in association with copper, lead, and zinc at the Tessalit polymetallic deposit in northern Mali; with uranium in Falea to the southwest of the country; and with gold at the Kalana and Morila gold mines (Mr. Fatiaga Kone, Geology Division Chief, Direction Nationale de la Géologie et des Mines, written commun., August 3, 2007).

Most of Mali's mineral deposits occur in the east and west of the country; diamond occurs mainly in the Kenieba area. Iron occurs in various geologic settings and types of deposits, the most important being the oolitic ironstones in the late Proterozoic sediments between the Bafing and the Bakoye Rivers west of Bamako, Mali's capital. A manganese deposit consisting of oxides on weathered gondites occurs in the eastern portion of the country. Bauxite deposits overlie late Proterozoic to Permian dolerites and occur in the western portion of the country along the Guinean border. The thickness of the bauxite deposits averages about 10 meters (m) and the Al_2O_3 content in these deposits varies from 39% to 48%. Lithium deposits from spodumene-bearing pegmatites occur in the southwest within the Bougouni area. Apatite, mica, niobium (pyrochlore), and rare-earth minerals are found in carbonatites along the eastern edge of the West African craton. Industrial minerals include barite, diatomite, fluorspar, kaolin, limestone, ornamental stone, and salt. Phosphate resources are located to the south and west of the Adrar des Iforas region. Limestone deposits are located in western Mali near the Bamako-Dakar railway southeast of Kayes. The In Kereit gypsum deposit is located north of Adrar des Iforas. Gypsum also occurs together with salt in the Taoudeni area within Quaternary sabkhas. Lignite and oil shale are said to occur to the west and southeast of the Adrar des Iforas Mountains. Birrimian greenstones that cover an area of about 23,000 km^2 host most of Mali's known gold deposits. Primary mineralization is said to be almost exclusively of two types: lode mineralization, with native gold in quartz veins and (or) in sulfides disseminated in hosting rocks; and stratabound mineralization in tourmalinized quartzites. Gold also occurs in elluvial and alluvial placers, which are the main source of gold mined by artisans (Kusnir, 1999).

Minerals in the National Economy

In 2006, the contribution of mining to the gross domestic product (GDP) increased to about 14% from 6% in 1998, mostly owing to the production of gold, which, in turn, accounted for about 80% of all mining activities in the country and 65% of the country's total exports. Artisanal and small-scale gold mining was the only source of income for many Malian families (Organisation for Economic Co-operation and Development, 2007, p. 349-350; U.S. Department of State, 2007; Lassana Guindo, Senior Geologist, Direction Nationale de la Géologie et des Mines, oral commun., Bamako, Mali, March 1, 2007).

Government Policies and Programs

The Government agency responsible for the mining sector in Mali is the Direction Nationale de la Géologie et des Mines (DNGM), which is part of the Ministère des Mines de l'Énergie et de l'Eau. Mali is divided into three mining districts: the west mining district, which comprises the administrative region of Kayes; the south mining district, which comprises the southern region of Koulikoro and Sikasso; and the north mining district, which comprises the regions of Gao, Kidal, and Tombouctou. The west mining district, in turn, is subdivided into four mining provinces: a mining province to the north of Kayes, which lies within the Guidimaka region; a mining province to the northeast of Kayes, which lies within the Nioro region; a mining province to the southeast of Kayes, which is host to the Loulo, the Sadiola, the Tabakoto, and the Yatela gold mines, to iron ore and uranium deposits, and to the majority of the country's known kimberlite pipes; and a mining province to the southeast of Kayes, which is host to bauxite, iron ore, limestone, and marble deposits. The south mining district is host to the Kalana and the Morila gold mines, to the Bale, the Kodieram, the Misséni, and the Syama gold deposits, and to the Bougouni lithium deposit. The north mining district is host to the Bah-el-heri and the Dimamou limestone deposits, the Darset gold deposit, the Tamaguilelt phosphate deposit, the Taoudeni salt mine, the Tassiga manganese deposit, and the Tessalit lead and zinc deposit (Direction Nationale de la Géologie et des Mines, 2007).

Production

In 2005, Mali was Africa's fourth ranked producer of gold after South Africa, Ghana, and Tanzania. In 2006, gold production increased by about 17% to 51,957 kilograms (kg) from 44,230 kg in 2005, mostly owing to increased production at the Kalana, the Loulo, the Sadiola, and the Yatela Mines and to new production from the Tabakoto Mine (table 1). No other mineral commodities were produced in significant quantities in the country with the exception of diamond, rock salt, and semiprecious stones, such as amethyst, epidote, garnet, prehnite, and quartz (Madame Anne Marie Camara, President, Union

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Nationale des Orpailleurs du Mali, oral commun., Bamako, Mali, March 2, 2007). The Government estimated the total artisanal production of semiprecious stones to be about 10,000 metric tons per year (t/yr). Rock salt was produced by artisanal miners in Taoudenni, northern Mali, and transported by camel to Tombouctou in blocks of about 66 pounds (reported as 30 kg) where it was sold locally and also exported to Burkina Faso and Niger. Mali did not produce cement. Cement was imported from Côte d'Ivoire, Ghana, Senegal, and Togo. Sand and gravel was produced by artisanal miners solely for domestic consumption. Marble and limestone were no longer produced in the country; gypsum production was stopped in 1990 (Lassana Guindo, Senior Geologist, Direction Nationale de la Géologie et des Mines, oral commun., Bamako, Mali, March 1, 2007).

Structure of the Mineral Industry

At least 19 international companies and dozens of local companies were engaged in gold exploration and production in Mali. These included Resolute Mining Ltd. of Australia; Canadian companies African Gold Group Inc., African Metals Corporation (AMC), Avnel Gold Mining Ltd., Axmin Inc., Delta Exploration Inc., Etruscan Resources Inc., Great Quest Metals Ltd., IAMGOLD Corp., Merrex Gold Inc., Nevsun Resources Ltd., North Atlantic Resources Ltd., and Robex Resources Inc.; Cyprus-based PAGE Management Limited; Glencar Mining plc of Ireland; AngloGold Ashanti Ltd. and Central African Gold (through Mali Gold Fields SA and Songhoi Ressources SA) of South Africa; and Cluff Gold plc and Randgold Resources Ltd. of the United Kingdom. Delta Exploration also explored for copper and uranium; Central African Mining and Exploration Company plc (CAMEC) of the United Kingdom explored for bauxite; Rio Tinto plc of the United Kingdom explored for diamond and planned to conduct a multicommodity (commodities not specified) exploration program in the country. Rio Tinto opened an office in Bamako in 2005 (Rio Tinto plc., 2006, p. 3, 9). Table 2 is a list of major mineral industry facilities.

Mineral Trade

Mali's exports to the United States were valued at about $8 million in 2006 compared with about $3.7 million in 2005; gold accounted for $141,000 of these exports. Imports from the United States were valued at about $43 million in 2006 compared with about $32 million in 2005. This total included nearly $1.1 million for excavating machinery, $60,000 for drilling and oilfield equipment, and $281,000 for specialized mining equipment (U.S. Census Bureau, 2007a, b).

Commodity Review

Metals

Bauxite and Alumina.—CAMEC (80%) signed a joint-venture agreement with Mali Mining House (a company established by members of the Union Nationale des Operateurs Miniers) (20%) for the exploration and possible development of three areas prospective for base metals, including bauxite. The project included the 300-km^2 Falea concession located in southwestern Mali near the border with Senegal and Guinea, the 2,500-km^2 Bamako West concession, and the 1,200-km^2 Sikasso North concession. In 2006, the partners conducted a remote sensing study for these areas, reviewed existing information on previous bauxite exploration, and planned to conduct further exploration in the country (Central African Mining and Exploration Company plc, 2006a, p. 7; 2006b, p. 10-11).

Gold.—In Mali, gold was produced at both the artisanal and industrial levels. Most of the artisanal gold produced in the country came from the Kenieba Valley. Orpailleurs (artisanal gold miners) recovered gold from alluvial deposits in Kenieba and, to a lesser extent, from other areas to the southeast of the country. The town of Kenieba is located about 500 kilometers (km) from Bamako.

About 100,000 of the 200,000 inhabitants of Kenieba were estimated to be directly engaged in gold mining; collectively, they produced about 2,100 kilograms per year (kg/yr) of gold, or about three times what the Kalana gold mine produced in 2006. At least 50% of all artisanal miners in Mali were women; these women were actively involved in all stages of the gold mining process. Gold produced by orpailleurs was sold in Bamako at a price of about $3.00 per gram and then exported from Bamako to the world at market prices (Madame Anne Marie Camara, President, Union Nationale des Orpailleurs du Mali, oral commun., Bamako, Mali, March 2, 2007, and Mamadou Keita, Secretary, Union Nationale des Orpailleurs du Mali, oral commun., Bamako, Mali, March 2, 2007).

Artisanal gold mining involved the use of rudimentary tools. Gold ore was crushed using large wooden poles and then processed by wind panning or water panning. In early 2007, a large migration of workers, triggered by the discovery of placer gold made by an orpailleur, started a new gold rush at the Moralia gold placer in Kenieba. Moralia is located within the premises of a gold property held under concession by Nevsun Resources. The Government estimated that about 10,000 miners were working the grounds at Moralia in 2007.

At the industrial level, gold was produced from the Kalana, the Loulo, the Morila, the Sadiola Hill, the Tabakoto, and the Yatela Mines. The Tabakoto Mine was opened on May 22, 2006; production as of yearend was 1,181 kg (reported as 37,976 troy ounces). Nevsun Resources, the company that operated the mine, was in the process of reviewing its strategy for the development of the Segala deposit, which is located about 4 km from the Tabakoto Mine, and expected to produce about 2,550 kg (reported as 82,000 troy ounces) in 2007 (Nevsun Resources Ltd., 2006b; 2007, p. 3).

Gold production at the Morila open pit gold mine decreased by about 20.6% to 16,070 kg in 2006 compared with 20,252 kg produced in 2005. Randgold Resources estimated that at current mining rates, mining activities at Morila would cease by 2009, although stockpiled material could extend the life of the mine for another 4 years. In 2006, total measured and indicated resources at Morila were reported to be about 30 million metric tons (Mt) at a grade of 2.61 grams per metric ton (g/t) gold (Randgold Resources Ltd., 2007, p. 24-31).

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Gold production at Loulo was expected to increase to about 12,000 kg (reported as 400,000 troy ounces) in 2007 as a result of the opening of the Yalea underground deposit (Mining Journal, 2006b). The Loulo Mine consisted of two main pits—Yalea and Gara (formerly known as Loulo 0)—and other smaller satellite pits. In 2006, the first underground sections at Yalea were being developed, and the company planned to develop a second underground section at Gara by 2008. Measured and indicated mineral resources at Loulo were estimated to be about 61.77 Mt at a grade of 4.64 g/t gold, and inferred resources were estimated to be about 22.8 Mt at a grade of 2.91 g/t gold. The expected life of mine for the Gara deposit was 13 years, and the expected life of mine for the Yalea deposit was 18 years (Randgold Resources Ltd., 2007, p. 8-20).

Gold production from the Sadiola Hill open pit gold mine increased to 15,552 kg in 2006 from 13,748 kg in 2005, mostly owing to the availability of better mining equipment, a milder rainy season, and higher grade sulfide ores. Output for 2007 was expected to decrease to about 13,800 kg as a result of the processing of lower grades of oxide material and a lower gold recovery rate for sulfide ore (IAMGOLD Corp., 2007, p. 10).

Gold production from the Yatela open pit mine increased by about 43% to 10,936 kg from the 7,651 kg produced in 2005. The increase in production was attributed to an increase in the amount of ore processed as a result of a milder rainy season. A cutback was performed on the main Yatela pit during the first quarter of 2006 and, as a result of the deepening of the pit, the estimated life of the Yatela Mine was extended to 2010; prior to this cutback, the Yatela Mine had been expected to close by 2007. Gold production at Yatela was expected to decrease by 22% in 2007, mostly owing to a reduction in mined ore and lower ore grades (IAMGOLD Corp., 2007, p. 37-38).

Production at the redeveloped Kalana underground gold mine increased by about 51.7% to 704 kg (reported as 22,638 troy ounces) from the 464 kg (reported as 14,923 troy ounces) produced in 2005, mostly owing to higher grades being mined and higher gold recovery rates (Avnel Gold Mining Ltd., 2007). Resolute Mining planned to begin production from the redeveloped Syama gold mine during the second half of 2008 at a cost of $120 million. The mine was expected to produce about 7,800 kg/yr of gold (reported as 250,000 troy ounces) (Mining Journal, 2006a).

Industrial Minerals

Diamond.—In Mali, diamond was recovered from both alluvial deposits (as a byproduct of artisanal gold mining) and from kimberlite pipes (tables 3, 4). The Kenieba region has been host to most diamond discoveries in the country, although some diamond had been recovered from gravels near the Bagoe, the Doundi, and the Niger Rivers.

The presence of diamond in the Kenieba region reportedly came to be known almost by accident. A 1954 police report generated in the city of Kankan, Guinea, which indicated the clandestine sale of a 137.5-carat diamond, allegedly from the Sansanto gold placer near the town of Kenieba, triggered a series of diamond exploration campaigns in the region. These exploration campaigns were undertaken by both the Government and private companies, and they were divided into two phases. One phase was undertaken between 1954 and 1984, and the other, between 1995 and 1998. The first exploration campaign (1954-1957) was conducted by Direction Fédérale des Mines et de la Géologie (DFMG), a Federal Government agency when Mali, known then as The French Sudan, was part of French West Africa (AOF). DFMG's exploration campaign led to the discovery of a 98-carat diamond in the Sansanto placer on the Doundi River in 1955, and of four kimberlite pipes known as the Kassama, the Kobato, the Sekonomata, and the Toromaya. The second and third independent exploration campaigns took place simultaneously from 1963 to 1966 and were conducted by Société Nationale de Recherche et d'Exploitation Minière (SONAREM) and Selection Trust (SELCO), a private company. Selection Trust's work resulted in the discovery of an additional seven kimberlite pipes: the Batifara, the Bilali, the Dabora, the Fanson, the Kenieba, the Orange, and the Silifoundou. The final exploration campaign (1978-1984) of the first phase was carried out by Syndicat Diamant Mali (SDM), which was a joint venture of the Government of Mali (DNGM), the Bureau de Recherches Géologiques et Minières (BRGM), and Mines et Ressources S.A. (MINERSA) of France (de la Cuesta, 1999, p. 10-14; Aussant and others, 2005, p. 20–25). DeBeers reportedly also evaluated the Kenieba area but the details of its findings were not disclosed. Exploration stopped after Mali's independence and the dissolution of AOF (Girard, 1998, p. 24; de la Cuesta, 1999, p. 1-30; Aussant and others, 2005, p. 20).

Exploration in Kenieba was resumed in 2003 after the Government granted an exploration permit to African Metals Corp. of Canada. As of yearend 2006, at least three Canadian companies were exploring for diamond in the area, including African Metals, Great Quest Metals, and Nevsun Resources. African Metals and Nevsun Mali Exploration Ltd. S.A. (a subsidiary of Nevsun Resources) signed a memorandum of agreement on July 5, 2006, to pool their interests in five diamond concessions in western Mali, known respectively as Dar Salam, Kenieba Nord, Kenieba Sud, Medinandi Sud, and Soumala. These two companies held under concession 23 of the 30 kimberlite pipes known to exist in Mali and 7 of the 9 kimberlite pipes known to be diamondiferous (Nevsun Resources Ltd., 2006a).

The largest diamond discovered to date in Mali was a 232.7-carat diamond known as La Belle de Sudan, which was recovered by orpailleurs near the Doundi River and was reportedly sold in Liberia (Madame Anne Marie Camara, President, Union Nationale des Orpailleurs du Mali, oral commun., Bamako, Mali, March 2, 2007, and Mamadou Keita, Secretary, Union Nationale des Orpailleurs du Mali, oral commun., Bamako, Mali, March 2, 2007).

In 2006, Mali's diamond industry consisted mainly of alluvial diamond recovered by orpailleurs as a byproduct of gold mining. The diamond production chain from discovery to export involved the artisanal miner, a merchant, a collector, and a buyer, which also appraised and exported the diamond from Bamako. The country had at least three appraiser-buyer-exporters, all of which were located in Bamako. Preliminary diamond production estimates were reported to be about 3,000 carats per year. This estimate is based on the account of

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three diamond buyers in Bamako, each of which exported about 900 carats per year, plus an additional 10% estimate to account for diamond sold by collectors elsewhere. Reportedly, not all diamond was sold through official channels and, as a result, many of the sales were unrecorded. In addition, some collectors south of Kenieba reportedly preferred to cross the border to Guinea to sell their diamond to buyers in the city of Kankan, and in other instances, artisanal miners decided to make the trip to Bamako to have their diamond appraised to avoid the use of an intermediary (François Lampietti, Consulting Geologist, U.S. Geological Survey, oral commun. Bamako, Mali, March 2, 2007, and Madame Anne Marie Camara, President, Union Nationale des Orpailleurs du Mali, oral communication, Bamako, Mali, March 2, 2007). As of yearend 2006, the country's diamond industry remained undeveloped; Mali was not a member of the Kimberley Process Certification Scheme.

Gemstones.—Artisanal miners produced semiprecious stones, including amethyst, epidote, garnet, prehnite, and quartz. The Government did not collect information on production but estimated the production of all semiprecious stones to be about 10,000 t/yr. Most of the garnet produced in the country was exported to Germany, and most of the prehnite was exported to China; semiprecious stones in general, however, were cut and polished by artisanal miners in Bamako (who were trained by the DNGM) and exported to markets in Asia, Europe, and the United States (Madame Anne Marie Camara, President, Union Nationale des Orpailleurs du Mali, oral commun., Bamako, Mali, March 2, 2007).

Mineral Fuels and Related Materials

Uranium.—In November 2006, Delta Exploration, through Société Delta Exploration Mali SARL, signed an agreement with the Government to explore and develop the Falea copper-uranium deposit. This deposit is located about 350 km west of Bamako and about 240 km south of Kayes (Delta Exploration Inc., 2006).

Outlook

The gold sector is likely to continue to dominate Mali's mineral industry in the short run. Total production of gold for 2007 is expected to decrease by about 10%, mostly owing to a decrease in production at the Sadiola Hill and the Yatela gold mines as a result of the processing of lower ore grades. In the next 4 to 5 years, however, the planned growth of the Loulo Mine, based on the development of the Yalea underground deposit, in addition to new production from the development of the Segala deposit and the extension of the life of mine at the Yatela Mine, will together help counterbalance the tapering off in production from the Morila Mine, which is scheduled to stop producing from its main pit in 2009.

Mali has the potential to develop a competitive mineral industry in the region. The presence of at least 19 companies engaged in gold exploration in the country in 2006, political stability, and a seemingly investor-friendly environment, which has recently attracted the interest of several foreign companies in assessing the country's undeveloped bauxite, copper, diamond, and uranium resources, seems to suggest that the presence of foreign mining interests in the country is likely to increase significantly in the coming years.

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TABLE 1
MALI: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004	2005	2006
Gold, mine output, gold content[3]	kilograms	56,043	45,535	37,911	44,230	51,957
Gypsum		-- r	-- r	-- r	-- r	--
Salt[e]		6,000	6,000	6,000	6,000	6,000
Semiprecious stones[4]		NA	NA	NA	NA	10,000 [5]

[e]Estimated; estimated data are rounded to no more than three significant digits. NA Not available. [r]Revised. -- Zero.

[1]Table includes data available through July 2007.

[2]In addition to the commodities listed, Mali also produced sand and gravel solely for domestic consumption, but information is inadequate to make reliable estimates of output.

[3]Excludes artisanal production, which is estimated to be about 2,100 kilograms per year.

[4]Artisanal production of semiprecious stones includes amethyst, epidote, garnet, prehnite, and quartz.

[5]Reported figure.

Source: Direction Nationale de la Géologie et des Mines

TABLE 2
MALI: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities[1]	Annual capacity
Gold		Société de la Mine d'or de Kalana (Avnel Gold Mining Ltd., 80%, and Government, 20%)	Kalana Mine, 300 km south of Bamako	60,000 ore.
Do.	kilograms	Société des Mines de Loulo (Randgold Resources Ltd., 80%, and Government, 20%)	Loulo Mine, 350 km west of Bamako	7,800.[2]
Do.		Morila S.A. [a subsidiary of Morila Ltd., 80% (AngloGold Ashanti Ltd., 40%; Randgold Resources Ltd., 40%; Government, 20%)	Morila Mine, 180 km southeast of Bamako	4,200,000 ore.
Do.		Société d'Exploitation des Mines d'Or de Sadiola S.A. (AngloGold Ashanti Ltd., 38%; IAMGOLD Corp., 38%; Government, 18%; International Finance Corp., 6%)	Sadiola Hill Mine, 77 km south of Kayes	5,300,000 ore.
Do.		Société des Mines de Syama S.A. (Resolute Mining Ltd., 80%, and Government, 20%)	Syama Mine, 300 km southeast of Bamako	Not operating.[3]
Do.		Société d'Exploitation des Mines d'Or de Yatela (AngloGold Ashanti Ltd., 40%; IAMGOLD Corp., 40%; Government, 20%)	Yatela Mine, 50 km southwest of Kayes	2,500,000 ore.
Do.	kilograms	Nevsun Resources	Kenieba valley	2,000.
Do.	do.	Artisanal miners	do.	2,100.

[1]Abbreviations for units of measure in this table include the following: km--kilometer.

[2]Production comes from the Gara and the Yalea open pits, as well as other smaller satellite pits. Production was expected to remain at about 7,800 kilograms per year (kg/yr) until 2009 and then to average above 10,900 kg/yr from 2009 to 2015.

[3]According to Resolute Mining Ltd. company reports, the feasibility study on the redevelopment of the Syama Mine was completed in 2005. The company announced a total resource of about 200,000 kilograms (reported as 6.4 million troy ounces of gold). A decision to proceed with the full development of the mine had not been reached as of yearend 2006.

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TABLE 3

MALI: KIMBERLITE PIPE DISCOVERIES AS OF 1999[1]

Name	Weight (in carats)	Discoverer
North Cirque	6.01; 0.80; 0.44; 0.08	Direction Fédérale des Mines et de la Géologie (DFMG).
South Cirque	0.3	Do.
Pipe 117	15 micro diamonds	Bureau de Recherches Géologiques et Minières (BRGM).
Orange River	0.05	Selection Trust (SELCO).
South Bilali	22.36 [2]	Do.
Batifara	0.15	Do.
Sekonomata	0.22	Direction Fédérale des Mines et de la Géologie (DFMG).
Fougola	micro diamond	Bureau de Recherches Géologiques et Minières (BRGM).
Mission	0.05	Selection Trust (SELCO).
Kassama	NA	Mali Diamond Exploration B.V. (MADE)
Kereko	NA	Do.
Tenin-Camara	NA	Do.
Delys	NA	Do.
Yaya	NA	Do.
Samba	NA	Do.
Fili-Yoro	NA	Do.
Sounkourou	NA	Do.
Koufara	NA	Do.
Kobato	NA	Direction Fédérale des Mines et de la Géologie (DFMG).
Toromaya	NA	Do.
Koufara	NA	Bureau de Recherches Géologiques et Minières (BRGM).
Maniaguinti	NA	Do.
Dabora	NA	Selection Trust (SELCO).
Pipe 47	NA	Bureau de Recherches Géologiques et Minières (BRGM).
Kenieba	NA	Selection Trust (SELCO).
Pipe 49	NA	Bureau de Recherches Géologiques et Minières (BRGM).
Silifoudou	NA	Selection Trust (SELCO).
Fanson	NA	Do.
Sakola	NA	Société Nationale de Recherche et d'Exploitation Minière (SONAREM).
North Bilali	NA	Selection Trust (SELCO).

NA Not available.

[1]Modified from de la Cuesta 1999, Mink International Resources Corp.

[2]Ten diamonds totaling 22.36 carats including one diamond of 7.4 carats and one diamond of 3.04 carats.

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TABLE 4

MALI: ALLUVIAL DIAMOND DISCOVERIES AS OF 1999[1]

Location	Weight (in carats)	Discoverer
Sansanto	232.70	Orpailleur
Sansanto	137.50	Do.
Sansanto/Doundi	102.00	Do.
Sansanto	98.00	Bureau de Recherches Géologiques et Minières (BRGM).
Toubandi	95.30	Orpailleur
Grioto/Doundi	55.50	Do.
Sansanto	51.70	Do.
Doundi	38.50	Do.
Kassama	35.00	Do.
Guindissou	34.00	Do.
Dialafoundou	32.00	Do.
Barroya/Doundi	15.00	Do.
Doundi	15.00	Do.
Kenieba/Doundi	3.68; 1.25; 1.0; 0.97; 0.40	Do.
Fekola/Faleme	1.60; 1.30	Do.
Diabakou/Disse	1.00; 0.28; 0.23; 0.03	Orpailleur/Bureau de Recherches Géologiques et Minières (BRGM).
Babara/Bayaya Fedo	1.00	Orpailleur
Heramakono/Gara	0.90; 0.70; 0.70; 0.10	Do.
Wasehi	0.70	Do.
Selou/Selouko	0.50	Do.
Daloto/Doundi	0.50	Do.
Kourafing/Koulia	0.42; 0.17; 0.15	Do.
Disse/Doundi	0.40; 0.15	Do.
Bilali Stream	0.35	Bureau de Recherches Géologiques et Minières (BRGM).
Sansanto	0.34; 0.01; < 0.01	Orpailleur/Bureau de Recherches Géologiques et Minières (BRGM).
Baboto/Gara River	0.30; 0.10; 0.03	Orpailleur
Diangadara/Diabokou	0.30	Do.
Stakili/Sekoto	0.27	Do.
Dialafara/Tamba	0.20	Do.
Sauradia/Faleme	0.18	Do.
Soumala	0.16; 0.09	Do.
Babara South	0.16	Do.
Sanboula/Diaoulaf	0.10	Bureau de Recherches Géologiques et Minières (BRGM).
Khassana	0.07	Do.
Dabia	0.05	Orpailleur
Linguekoto/Gara	0.05	Do.
Koundam	0.01; micro diamond	Bureau de Recherches Géologiques et Minières (BRGM).
Diakema/Tamba	0.01	Selection Trust (SELCO).
Faleme/Gara	micro diamond	Bureau de Recherches Géologiques et Minières (BRGM).
Faleme/Doundi	micro diamond	Do.

[1]Modified from de la Cuesta 1999, Mink International Resources Corp.

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THE MINERAL INDUSTRIES OF MAURITANIA AND NIGER

By Omayra Bermúdez-Lugo

MAURITANIA

Mauritania's mineral sector was dominated by iron ore mining and beneficiation. Other mineral commodities produced in the country included cement, copper, gold, gypsum, petroleum, salt, and steel. The country's identified mineral resources included about 160 million metric tons (Mt) of phosphate rock, 120 Mt of salt, 22.6 Mt of copper ore, 9 Mt of gypsum, more than 1 Mt of sulfur, 400,000 metric tons (t) of peat, and 30 t of gold. Iron ore reserves were estimated to be 185 Mt of hematite ore ranging from 60% to 68% iron and 660 Mt of magnetite ore ranging from 36% to 40% iron. The mining sector was regulated by the Mining Code of 1999, the Investment Code of 2002, and the Petroleum Code of 1988 (Ministère des Mines et de l'Industrie, 2005, p. 14, 27).

Minerals in the National Economy

Mining, which was one of the country's most important sectors to the national economy, contributed about 12% of the gross domestic product (GDP) and represented more than one-half of the country's export earnings in 2005 (Ministère des Mines et de l'Industrie, 2005, p. 7, 27). According to the Ministère des Mines et de l'Industrie (MMI), the development, diversification, and promotion of the mining sector have become the Government's priority in recent years. The number of foreign companies applying for prospecting licenses was increasing, and projects were at various stages ranging from grassroots exploration to mine development.

Production

Data on mineral production are provided in table 1.

Structure of the Mineral Industry

The MMI was the Government agency responsible for enacting the Mining Code and for the coordination of all activities in the mining sector. The Direction des Mines et de la Géologie was the entity responsible for promoting the mineral sector and for providing geologic and mining information to potential investors; the Direction des Hydrocarbures was in charge of the development of the petroleum sector; and the Office Mauritanien des Recherches Géologiques was the Government entity responsible for evaluating areas of mineral potential for exploration. Société Nationale Industrielle et Minière (SNIM) was responsible for iron ore production and beneficiation. The company operated a mining center at the northern town of Zouerate, three open pit iron ore mines at Guelb El Rhein, Kedia d'Idjill, and M'Haoudat in northern Mauritania, port facilities at Nouadhi on the Atlantic coast, and a railway that linked the mining center to the port facilities (Ministère des Mines et de l'Industrie, 2005, p. 9-10, 28). Table 2 is a list of major mineral industry facilities.

Commodity Review

Metals

Copper.—First Quantum Minerals Ltd. of Canada produced its first copper in concentrate from the Guelb Moghrein copper-gold mine in July 2006; commercial production began in October 2006. The Guelb Moghrein Mine is located in the Inchiri region near the town of Akjoujt about 250 kilometers (km) northeast of Nouakchott. The mine was expected to reach its designed capacity of 30,000 metric tons per year (t/yr) of copper concentrate by the first half of 2007. Measured and indicated resources at Guelb Moghrein were reported to be 23.7 Mt. First Quantum held an 80% interest in the mine, and Guelb Moghrein Mines d'Akjoujt S.A. held the remaining 20% (First Quantum Minerals Ltd., 2007a, p. 8; 2007b).

Gold.—First Quantum produced its first gold, which amounted to 322 kg, from the Guelb Moghrein copper-gold mine in July 2006. The designed capacity of the mine was about 2,200 kilograms per year (kg/yr) of gold (reported as 70,000 troy ounces per year) (First Quantum Minerals Ltd., 2007a, p. 8).

Canada-based Rio Narcea Gold Mines Ltd. continued to work on the development of the Tasiast gold mine. Construction work, which was ongoing throughout 2006, was expected to be completed by the first half of 2007, with first production scheduled to begin shortly thereafter. In October, the company announced a revised mineral resource estimate of about 12 Mt at a grade of 2.7 grams per metric ton (g/t) gold compared with a previous resource estimate of about 8.9 Mt at a grade of 3.08 g/t gold. The mine was expected to produce about 3,300 kg/yr (reported as 105,000 troy ounces per year) during a period of 8 years. Projected capital expenditures for Tasiast were $73 million (Mining Journal, 2006a; Rio Narcea Gold Mines Ltd., 2006a, b).

Iron Ore.—A three-stage bankable feasibility study for the development of the Guelb el Aouj iron ore project was underway during the year. Perth-based Sphere Investments Ltd. of Australia (SIL) was to fund the first $11 million to earn a 50% interest in the project, which consisted of a 17-million-metric-ton-per-year (Mt/yr) iron ore open pit mine, and a 7-Mt/yr beneficiation and direct-reduced-iron (DRI) pelletizing plant. A resource definition drilling campaign for the project, which was completed in 2006, outlined a new resource estimate yielding measured, indicated, and inferred resources of high-quality magnetite-quartzite of about 701 Mt compared with the 450 Mt previously reported by the company. SIL expected to complete the bankable feasibility study by the second quarter of 2007, to begin construction work by 2008, and to produce the first DRI pellets by the second half of 2010. The life of the mine was projected to be 30 years (Mining Journal, 2006b; Sphere Investments Ltd., 2007, p. 2-6).

During the second quarter of 2006, Saudi Basic Industries Corp. through its wholly owned subsidiary Saudi Iron and Steel Company (Hadeed), and Qatar Steel Company (QASCO)

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invested about $22 million in SIL as part of a new strategic iron ore partnership under which Hadeed and QASCO were to secure a source of high-grade DRI pellets as feed for their respective steel plants. In addition to working on the Guelb el Aouj project, SIL completed a reconnaissance diamond-drilling program for the Tintekrate Bou Derga deposits, which are located in the southern part of the area that makes up Guelb el Aouj. The envisioned mine will make use of SNIM's existing iron ore railway and port infrastructure (Mining Journal, 2006b; Sphere Investments Ltd., 2007, p. 2-6).

Mineral Fuels and Related Materials

Petroleum.—Mauritania began producing its first petroleum from the Chinguetti oilfield in February 2006. The Chinguetti oilfield was owned by a consortium of companies that included BG Group plc, Hardman Resources Ltd., Premier Oil plc, Roc Oil Ltd., Government-owned Société Mauritanienne de Hydrocarbures, and Woodside Petroleum Ltd. Petroleum production from the Chinguetti field was expected to average 75,000 barrels per day (bbl/d). The first 1 million barrels produced were shipped to International United Petroleum & Chemicals Co. Ltd. of China, which was the trading arm of China Petroleum and Chemical Corp. Petroleum reserves at Chinguetti were estimated to be 120 million barrels (North Africa Journal, The, 2006; Woodside Petroleum Ltd., 2006). Companies exploring for petroleum in the country during 2006 included Baraka Petroleum Ltd. of Australia in joint venture with CNPC International Ltd. of China, which planned to drill the Heron-1 well, and Dana Petroleum plc of the United Kingdom, which on December 5 announced the discovery of petroleum at its offshore Aigrette-1 exploration well in Block 7 (Dana Petroleum plc, 2006; Rigzone.com, 2006).

Uranium.—At least two companies were exploring for uranium during the year. Perth-based Murchison United NL was granted five uranium exploration licenses covering an area of 6,766 square kilometers (km^2) in Bin En Nar and in Bir Moghrein and was awaiting approval of three other uranium exploration licenses by the Government. The company conducted ground reconnaissance work to perform detailed radiometric studies on five anomalies. The results of these studies were yet to be analyzed as of yearend (Murchison United NL, 2006).

On November 8, 2006, Alba Mineral Resources plc (Alba) of the United Kingdom acquired a 50% interest in Mauritania Ventures Limited (MVL). MVL held two uranium exploration licenses in northern Mauritania. Alba applied for a third exploration license in the northern part of the country and for gold and base-metal exploration licenses covering an area of about 6,000 km^2 located near the uranium exploration properties. Alba also applied for an additional five copper-gold-iron oxide permits in the southern part of the country (Alba Mineral Resources plc, 2006).

Outlook

The recent coming online of the Chinguetti petroleum field in addition to ongoing petroleum exploration and the discovery of petroleum at the Aigrette-1 well suggest that the petroleum sector is likely to become a significant contributor to the national economy. This sector is likely to drive the growth of the mineral sector in the near future. Petroleum exports, which are projected to total about 18.6 million barrels per year, will reportedly generate revenues of up to $1 billion, of which the Government is expected to earn an estimated 22.5%. The expected positive prospects have already reportedly led the Government to double the wages of state employees and allowed the resumption of social and economic projects in the country that had been frozen for years owing to the lack of resources and political instability (North Africa Journal, The, 2006).

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NIGER

Mineral commodities produced in Niger included cement, coal, gold, gypsum, limestone, salt, silver, tin, and uranium. In 2006, Niger was the world's fourth ranked producer of uranium (Uranium Information Centre Ltd., 2007).

A new Mining Code was adopted in August 2006. Under the new Mining Code, the National Mine Research Office, whose responsibilities included organizing mining exploration programs, was replaced by two newly established entities: the Geological and Mining Research Center and Société du Patrimoine des Mines du Niger (SOPAMIN). SOPAMIN is to hold the state's shares in the existing uranium companies and is in charge of engaging in commercial transactions, such as uranium sales. Since the adoption of the new Mining Code, the Government has issued a significant number of new mineral exploration permits. Niger joined the Extractive Industry Energy Initiative (EITI) in 2005 and, as part of the EITI efforts,

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appointed in late 2006 a national consultative committee, which included representatives of the general public. A first audit report reconciling revenue paid by mining companies with Government receipts was scheduled to be issued in late 2007 (International Monetary Fund, 2007b, p. 5; 2007c, p. 9).

Minerals in the National Economy

Niger's mineral sector accounted for about 3% of the GDP and for about 40% of exports. According to the International Monetary Fund (IMF), a renewed interest in the generation of nuclear energy had led to increased demand for uranium, encouraged investment expansions at existing uranium mines, and promoted exploration. Foreign direct investment in the sector from 2008 to 2012 was projected to be $1.4 billion, which would double the country's uranium production capacity (International Monetary Fund, 2007a, p. 9).

Production

Gold production decreased by about 47% to 2,615 kilograms (kg) in 2006 from 4,962 kg in 2005, mostly owing to mechanical breakdowns at the Samira Hill Mine mill. Data on mineral production are provided in table 1.

Structure of the Mineral Industry

Table 2 is a list of major mineral industry facilities.

Commodity Review

Mineral Fuels and Related Materials

Petroleum.—Niger did not produce petroleum and depended upon imports to meet its domestic requirements. In October 2006, TG World Energy Corp. of Canada spudded the Saha-1 well, which was the first well in a three-well drilling program that the company planned to carry out through 2007. The well flowed uneconomic quantities of petroleum and was abandoned as noncommercial. The company's next target, the Fachi West-1 exploration well, was to be drilled by May 2007. TG World's future plans included the drilling of a third exploration well at a location that was to be determined after the results of Fachi West-1 were known, and the acquisition of an additional 700 km of two-dimensional (2-D) seismic data for regional and prospect-specific coverage in the Ténéré Block (TG World Energy Corp., 2007, p. 1, 5).

Uranium.—In addition to Paris-based Areva NC, which was the country's sole uranium producer, at least three companies were exploring for uranium in Niger in 2006. These companies included Bayswater Uranium Corp., a group of companies led by China National Uranium Corp., and North Atlantic Resources Ltd.

Production of uranium, which increased by about 11% in 2006, came from the Akouta underground mine, which was operated by Compagnie Minière d'Akouta (COMINAK), and the Arlit open pit mine, which was operated by Société des Mines de l'Aïr (SOMAIR). COMINAK was owned by Areva NC (34%), the Government of Niger (31%), Overseas Uranium Resources Development Company of Japan (25%), and ENUSA Industrias Avanzadas, S.A. of Spain (10%) and employed about 1,100 people. SOMAIR was owned by Areva NC (63.4%) and the Government of Niger (36.6%) and employed about 600 people. An action plan was being implemented at COMINAK to optimize production while the company prepared to mine the new Afasto ore body at the end of 2007. In 2006, the company was granted exploration permits for the Agebout and the Afouday areas and worked on the characterization of the Imouraren ore body to determine its commercial feasibility. Areva NC submitted 19 new permit applications in 2006 in accordance with the recently amended Nigerien mining law. The Imouraren permit, which was located about 80 km south of Arlit, was granted in July 2006. The permit included an ore body discovered in 1969 that Areva NC planned to mine owing to favorable market conditions. One hundred people were employed at the site in 2006. More than 55 km of development drilling had been completed at the site during a period of 1 year and more than 2 t of ore had been shipped for testing to Areva NC's laboratories (Areva NV, 2006, p. 62-71).

Bayswater Uranium Corp. applied for 16 uranium concessions covering 8,000 km^2 in two blocks in Niger. According to the company, the granting of the exploration concessions was delayed while the Government reviewed the country's Mining Code; the review was completed on November 1, 2006. Bayswater was required to reapply for the concessions. The company expected to receive Government approval and planned then to conduct airborne radiometric and magnetic surveys and followup prospecting of anomalous targets to define uranium targets of interest for subsequent drilling (Bayswater Uranium Corp., 2007, p. 7).

A group of companies led by China National Uranium Corp. was granted uranium exploration licenses covering the areas of Madaouela and Teguidda in the Agadez region, which is located about 1,000 km northeast of Niamey (Creamer Media's Mining Weekly, 2006; Mining Journal, 2006).

North Atlantic Resources Ltd. was granted a uranium exploration license for the 1,963-km^2 Abelajouad property, which is located in the Arlit region about 800 km from Niamey. Under the terms of the agreement with the Government, the company was to invest about $2.2 million during a period of 3 years to maintain its interest in the property. If the project were to advance to commercial production, the Government would retain a 10% carried interest and up to a 20% participating interest in the project (North Atlantic Resources Ltd., 2007, p. 3).

Outlook

The IMF estimates that real GDP growth in Niger is likely to reach 4.5% in 2007 owing, in part, to the development of the gold and uranium sectors. The adoption of a new Mining Code under which the Government is to participate in new mining development initiatives with the private sector and renewed international interest in the generation of nuclear energy, suggest that Niger is likely to benefit from an increase in foreign direct investment in the mineral sector in the near future.

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More-extensive coverage of the mineral industry of Niger can be found in the 2003, 2004, and 2005 U.S. Geological Survey Minerals Yearbook, volume III, Area Reports—International—Africa and the Middle East, which are available on the World Wide Web at http://minerals.usgs.gov/minerals/pubs/country.

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TABLE 1
MAURITANIA AND NIGER: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Country and commodity		2002	2003	2004	2005	2006
MAURITANIA[2]						
Cement		200,000 e	200,000 e	300,000	300,000 e	373,963
Copper in concentrate		--	--	--	--	5,031
Gold	kilograms	--	--	--	--	322
Gypsum		100,000 e	34,264	38,940	43,266 r	45,222
Iron ore:						
Gross weight	thousand metric tons	9,553 [3]	10,377 [4]	10,674 r, [4]	10,752 r	11,155
Iron content e	do.	6,200	6,890	6,900 r	7,000 r	7,250
Petroleum, crude	thousand 42-gallon barrels	--	--	--	--	11,170
Salt		5,500 e	15	20	20 e	20
Steel, crude		5,000	5,000 e	5,000 e	1,263 r	1,065
NIGER[5]						
Cement, hydraulic e		53,700 [6]	53,700	53,700	53,700	53,700
Coal, bituminous		182,916	183,000 e	183,000 e	182,060 r	176,320
Gold	kilograms	28 [7]	30 e, [7]	684 [7]	4,962 r	2,615
Gypsum		17,652	17,700 e	17,700 e	17,417 r	13,043
Limestone		146,399	146,000	146,000	146,000	146,000
Salt e		2,000	2,000	2,000	1,269 r, [6]	1,300
Silver	kilograms	NA	NA	NA	201 r, [6]	200
Sulfuric acid:						
Gross weight		62,000	67,000	70,000	70,000 e	70,000 e
Sulfur content e		20,000 [3]	22,000	23,000	23,000	23,000
Tin, mine output, Sn content		11	11 e	3,100 e	14 r, [3]	13
Uranium, U content		3,076	3,143 [3]	3,282	3,093	3,434

eEstimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. rRevised. NA Not available. -- Zero.

[1]Table includes data available through November 1, 2007.

[2]In addition to the commodities listed, modest quantities of crude construction materials (clays, sand and gravel, and stone) presumably were produced, but output was not reported quantitatively. The minimill of Société Arabe de Fer et d'Acier en Mauritanie produced rebar and wire, but available information is inadequate to make reliable estimates of output.

[3]Reported by National Industrial and Mining Company.

[4]Reported by Ministère des Mines et de l'Industrie.

[5]In addition to the commodities listed, phosphate rock, tungsten ore, and a variety of construction materials (clays, sand and gravel, and stone) were produced but information is inadequate to make reliable estimates of output.

[6]Reported figure.

[7]Does not include production from artisanal miners.

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TABLE 2
MAURITANIA AND NIGER: STRUCTURE OF THE MINERAL INDUSTRIES IN 2006

(Metric tons unless otherwise specified)

Country and commodity		Major operating companies	Location of main facilities	Annual capacity
MAURITANIA				
Cement		Ciment de Mauritanie (Private Mauritanian investors, 90%, and Compañía Valenciana de Cementos Portland, 10%)	Nouakchott	545,000 cement and clinker.
Do.		Mauritano-Francaise des Ciments S.A.	do.	NA.
Copper		First Quantum Minerals Ltd., 80%, and Guelb Moghrein Mines d'Akjoujt S.A, 20%	Guelb Moghrein copper-gold mine	30,000 concentrate.
Gold	kilograms	do.	do.	2,200.
Gypsum		Société Arabe des Industries Metallurgiques Mauritano-Koweitiennes (SAMIA)	Sebkha N'dramcha between Nouakchott and Akjoujt	NA.
Iron ore		Société Nationale Industrielle et Minière (SNIM) (Government, 78%, and Arab financial and mining investors, 22%)	Guelb El Rhein, Kedia d'Idjill, and M'Haoudat Mines	12,000,000 ore.
Do.		Sphere Investments Ltd., 50%, and Société Nationale Industrielle et Minière (SNIM), 50%	Guelb el Aouj Mine[1]	17,000,000 ore; 7,000,000 direct-reduced iron.
Salt		Société Mauritanienne des Industries du Sel (SOMISEL)	N'terert and d'Idjill brine pits	NA.
NIGER				
Coal		Société Nigérienne de Charbon (SONICHAR)	Anou Araren, central Agadez region	300,000.
Gold	kilograms	Société des Mines du Liptako S.A. (SML) [African GeoMin Mining Development Corporation Ltd. (which is owned by Etruscan Resources Inc., 50%, and Semafo Inc., 50%), 80%, and Government, 20%]	Samira Hill Mine, 90 kilometers west of Niamey	3,000.
Uranium		Compagnie Minière d'Akouta (COMINAK) [Areva NC, 34%; Government, 31%; Overseas Uranium Resources Development Co., 25%; ENUSA Industrias Avanzadas S.A., 10%]	Akouta underground mine, northern Niger	2,500.
Do.		Société des Mines de l'Aïr (SOMAIR) (Areva NC, 63.4%, and Government, 36.6%)	Arlit open pit mine, northern Niger	2,300.

NA Not Available.
[1]Under development. First production expected during the second half of 2010.

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The Mineral Industries of Morocco and Western Sahara

By Harold R. Newman

MOROCCO

Mining was significant to the Moroccan economy. The mineral industry, which was dominated by phosphate production, was Morocco's leading foreign exchange earning sector. Omniun Nord Africain (ONA) was the leading private sector investor through its equity interest in Managem S.A. and Société Nationale d'Ivestissement S.A. (SNI). Managem operated six mines in Morocco: the Akka gold mine, the Bou-Azzer cobalt mine, the Draa Sfar and the Guemassa copper-lead-zinc mines, the El Hammam fluorspar mine, and the Imiter silver mine.

Minerals in the National Economy

In 2006, more than 80 mining companies operated in Morocco, and they produced more than 25 different commodities and employed more than 37,000 people. The mineral industry accounted for 35% of the value of foreign trade and about 6% of the gross domestic product (MBendi Information Services (Pty) Ltd., 2006).

Government Policies and Programs

The Office National des Hydrocarbures et des Mines (ONHY) is the Government agency responsible for the exploration and promotion of national mineral resources. Office Chérifien des Phosphates (OCP), another Government agency, manages phosphate rock mining and beneficiation and owns most of the phosphoric acid and phosphate fertilizer production facilities. These agencies work closely with the Ministry of Energy and Mines. All mineral resources are the property of the state, which issues permits and licenses for exploration and exploitation of the resources.

Production

Morocco was one of the world's leading producers of phosphate rock. In terms of the value of production, phosphate rock was Morocco's most important mineral. In addition to phosphate rock, the country produced a wide variety of minerals, which included barite, clays, coal, cobalt, copper, fluorspar, gold, iron ore, lead, nickel, petroleum, salt, silver, talc, and zinc. The Bou-Azzer cobalt deposit is the world's only primary cobalt deposit, and the Imiter Mine produces substantial amounts of silver. Buoyed by external mineral demand, activities within the Moroccan mining sector continued to expand (Report Buy, 2006).

Structure of the Mineral Industry

The Government was taking steps to privatize selected state-owned mining assets and to launch reform programs within the mining sector to boost its competitiveness. The structure of the mineral industry, however, changed very little during the year. Table 2 is a list of major mineral industry facilities.

Mineral Trade

U.S. exports to Morocco were valued at about $876 million in 2006 compared with $525 million in 2005. This total included more than $19 million for petroleum products, $12 million for coal and other fuels, $5 million for nonmetallic minerals, and $3 million for metallurgical grade coal (U.S. Census Bureau, 2006a). Imports from Morocco were valued at about $521 million in 2006 compared with $446 million in 2005. This total included about $104 million for sulfur and nonmetallic minerals, more than $28 million for petroleum products and fuel, $8 million for miscellaneous nonferrous metals, and $880,000 for drilling and oilfield equipment (U.S. Census Bureau, 2006b).

Morocco and the United States signed a Free Trade Agreement (FTA) that went into effect on January 1, 2006; the agreement eliminated tariffs on 95% of bilateral trade, and the remaining tariffs were to be eliminated during the next 9 years. The U.S.-Morocco FTA was the first in Africa and the first under the Middle East Free Trade Initiative (U.S. Energy Information Administration, 2006).

Commodity Review

Metals

Cobalt.—Compagnie de Tifnout Tiranimine (CTT), which was a subsidiary of Managem, mined cobalt ore at Bou-Azzer. The cobalt is associated with arsenic in narrow vein structures found at the contact of a serpentine and quartz-rich diorite. The mineralized veins are vertically continuous for an estimated 200 meters (m). The deposit is accessed through shafts that reach down to 400 m below the surface. A cut and fill method of mining is used on 40-m to 50-m spaced levels. Cobalt concentrates and tailings from Bou-Azzer were refined at Compagnie Minière de Guemassa's plant, which also produced about 6,000 metric tons per year (t/yr) of arsenic trioxide (Maptek (Pty) Ltd., 2006).

Copper.—Odyssey Resources Ltd. of Canada completed a sampling program at two past-productive copper-silver deposits near the company's Anti Atlas copper-silver property. A drilling program was underway at the Alous property, and the first two holes were completed. Preliminary inspection indicated that copper mineralization extended from the surface to about 70 m below the surface. Samples were shipped to ALS Chemex of Canada for assaying and column leach tests (Odyssey Resources Ltd., 2006).

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Silver.—Silver in Morocco occurs both as the primary metal in ore deposits at Igoudrane and Imiter and as a byproduct of cobalt, copper, lead, and zinc mining operations. Most of the country's silver production came from the Imiter Mine, which was owned and operated by Société Metallurgique d'Imiter (SMI), a subsidiary of Managem. SMI also produced silver ingots (Alacra Store, 2006).

Industrial Minerals

Cement.—The Moroccan cement industry comprised four companies: Asment de Temara; Holcim (Maroc) S.A.; Lafarge S.A. (Lafarge), through Lafarge Ciments (Maroc), which was a 50% owned subsidiary of the Lafarge Group of France; and Société les Ciments du Maroc S.A.

Diamond.—Metalex Ventures Ltd. of Canada continued to explore for diamond in southern Morocco during the year. The company's concession covered an area of 24,800 square kilometers (km^2) of Archean cratonic and Proterozoic rocks, which the company considered to be highly prospective for diamond-bearing kimberlite. Metalex completed the preliminary exploration and was finalizing a joint-venture agreement for further exploration (Google Finance, 2006).

Phosphate Rock.—OCP was the sole producer of phosphate rock, which accounted for about one-half of the nation's income. Morocco was the world's leading exporter of phosphate rock, with a 42% share of global exports. Morocco also held the largest share (70%) of the world's total known phosphate reserves. OCP mined phosphate rock from Benguerir, Khouribga, and Youssoufia. The company's Khourigba operations covered a radius of 30 kilometers and included three mines—Sidi Chennane Mine, Mera El Arech Mine, and Sidi Daoui Mine, which had production capacities of 8 million metric tons per year (Mt/yr), 6 Mt/yr, 4 Mt/yr, respectively. Phosphate rock is found mainly in the western part of Morocco (Mining Technology, 2006).

Mineral Fuels

As of January 2006, Morocco had proven oil reserves of about 1 million barrels and natural gas reserves of about 1.7 billion cubic meters. The country produced small volumes of natural gas and petroleum from the Essaouira Basin and small amounts of natural gas from the Gharb Basin. Morocco was North Africa's leading importer of petroleum and natural gas. The potential for hydrocarbon resources was thought to exist in large, yet-to-be-explored areas of Morocco. Morocco was a transit center for Algerian gas exports to Portugal and Spain; gas exports were transported across the Strait of Gibraltar via the Maghreb-Europe gas pipeline. Morocco's two refineries, which were located at Mohammedia and Sidi Kacem, had a combined capacity of about 155,000 barrels per day (U.S. Energy Information Administration, 2006).

Island Oil and Gas Co. announced that ONHY had approved an Exclusive Reconnaissance License in the Zag Basin onshore Morocco. The license, valid for a period of 12 months (until December 2008), covered an area of 21,807 km^2. The Zag Basin is an under-explored Paleozoic North African sedimentary basin within which no seismic data had been acquired by yearend 2006. An active petroleum system was believed to be present in this basin based upon early drilling history and the presence of a source rock equivalent to that which hosts the major Paleozoic natural gas and petroleum fields of neighboring countries (Alexander's Gas & Oil Connections, 2006).

Outlook

The Government planned to establish joint ventures with foreign companies and to bring the Jorf Lasfar phosphoric acid and sulfuric acid plants online by 2008. The Government was expected to sign a memorandum of understanding with Sinochem Corp. of China for the development of another phosphoric acid plant at Jorf Lasfar by 2011. These actions suggest that the phosphate industry is likely to continue to dominate Morocco's mineral sector for the next 6 to 8 years.

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WESTERN SAHARA

The issue of sovereignty for Western Sahara remained unresolved in 2006. The territory, a desert area bordering the Atlantic Ocean between Mauritania and Morocco, was contested by Morocco and the Popular Front for the Liberation of the Saguia el Hamra and Rio de Oro (Polisario), an independence

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movement based in Tindouf, Algeria. Western Sahara's economy was dependent on pastoral nomadism, fishing, and phosphate mining. Interest in oil exploration contracts in areas offshore Western Sahara increased during 2006 (U.S. Energy Information Administration, 2006).

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TABLE 1
MOROCCO AND WESTERN SAHARA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004[e]	2005	2006[e]
METALS						
Antimony, sodium antimonate		532	500	500	500	500
Cobalt:						
Concentrates, gross weight		16,896	16,178	18,410 r	13,030	13,000
Co content		1,453	1,391	1,600	1,100	1,100
Metal[3]		1,354	1,431	1,594 r	1,613	1,405 [4]
Copper:						
Concentrates, gross weight		17,799	17,539	14,200 [4]	12,650	12,000
Cu content, concentrates		5,000	4,900	4,400	3,800 r	4,500 r
Gold	kilograms	2,747	1,863	1,493 r	1,786	1,800
Iron and steel:						
Iron ore:						
Gross weight		8,736	6,300	9,900 [4]	8,130	8,100
Fe content[e]		4,700	3,400	5,300	4,400	4,400
Metal:[e]						
Pig iron		15,000	15,000	15,000	15,000	15,000
Steel, crude		5,000	5,000	5,000	5,000	5,000
Lead:						
Concentrate:						
Gross weight		88,582	54,779	58,810 r	59,920	60,000
Pb content		62,400	38,600	41,400 r	42,200	45,000
Cupreous matte, Pb content[e]		600	600	600	600	60
Metal:						
Smelter, primary only		71,840	62,000	40,712 r	54,460	49,200 [4]
Refined:						
Primary		71,840	61,473	35,000 [4]	38,600 r	44,700
Secondary[e]		3,000	3,000	4,000 [4]	4,000	3,000
Total[e]		75,000	64,000	39,000	39,000	47,700
Manganese ore, largely chemical-grade		18,064	--	9,050 r	11,270	11,000
Mercury[e]		10	10	10	10	10
Nickel content of nickle sulfate		109	126	130 r	99 r	80 [4]
Silver:						
Ag content of concentrates	kilograms	57,000 [e]	25,400 [e]	26,000	26,000	50,700
Ag content of matte and smelter bullion	do.	220,000 [e]	175,155	170,000 [e]	170,000	195,000
Total	do.	276,789	200,529	195,952 [4]	195,952	245,700 [4]
Zinc concentrate:						
Gross weight		178,476	136,433	146,200 [4]	151,270	130,000
Zn content		90,487	69,200	72,363 [4]	78,660 [4]	72,600

See footnotes at end of table.

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TABLE 1--Continued

MOROCCO AND WESTERN SAHARA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004[e]	2005	2006[e]
INDUSTRIAL MINERALS						
Arsenic trioxide		5,469	6,872	6,866 [r]	8,939	8,900
Barite		469,934	358,500	355,800 [r]	475,575	612,800 [5]
Cement, hydraulic	thousand metric tons	10,200 [e]	10,400	11,000	11,000	11,000
Clays, crude:						
Bentonite		58,754	67,000	85,400 [4]	64,350	65,000
Fuller's earth (smectite)		43,243	14,944	28,700 [r]	29,060	30,000
Montmorillonite (ghassoul)		2,329	927	1,240 [r]	1,010	1,000
Feldspar		19,401	20,000	30,270 [r]	27,795	28,000
Fertilizers	thousand metric tons	2,602	2,542	2,405 [4]	2,400	2,400
Fluorspar, acid-grade		94,911	81,255	112,100 [4]	114,740	114,000
Gypsum[e]		600,000	600,000	600,000	600,000	600,000
Phosphate rock:						
Gross weight[5]	thousand metric tons	23,038	22,877	26,675 [r]	28,788	28,000
P_2O_5 content	do.	7,700	7,400	8,507 [r]	9,195	9,100
Phosphoric acid	do.	2,921	2,930	3,254 [4]	3,392	3,300
Salt:[6]						
Rock		266,903	236,700	253,800 [r]	319,900	320,000
Marine[e]		27,622 [4]	36,000	36,000	36,000	36,000
Total		294,525	272,700	289,800 [r]	356,000	356,000
Strontium minerals, celestite		3,780	2,700	2,700	2,700	2,700
Sulfuric acid		8,600	8,900	9,500	9,500	9,500
Talc and pyrophyllite		39,612	1,959	255 [r]	--	--
MINERAL FUELS AND RELATED MATERIALS						
Coal, anthracite		322	214	200	200	200
Gas, natural:						
Gross	million cubic meters	63	61	40	40	40
Dry[e]	do.	55	54	35	35	35
Petroleum:						
Crude	thousand 42-gallon barrels	49	90	246	245	240
Refinery products:						
Liquefied petroleum gas	do.	2,690	1,000	3,000	3,000	3,000
Gasoline	do.	3,210	1,500	3,200	3,300	3,300
Jet fuel	do.	1,090	500	1,000	1,000	1,000
Kerosene	do.	620	300	900	900	900
Distillate fuel oil	do.	17,330	8,549 [r]	24,000	24,000	24,000
Residual fuel oil	do.	14,000	8,022 [r]	17,000	18,000	18,000
Other	do.	1,450	4,420 [r]	2,000	2,000	2,000
Total	do.	40,390	24,291	51,000	52,000	52,000

[e] Estimated, estimated data are rounded to no more than three significant digits; may not add to totals shown. [r] Revised. -- Zero.

[1] Includes data available through November 28, 2007.

[2] In addition to the commodities listed, perlite and a variety of crude construction materials are produced, but information is inadequate to make reliable estimates of output.

[3] Cobalt electrowon from cobalt concentrates and tailings from the Bou-Azzer Mine.

[4] Reported figure.

[5] Reported production.

[6] May include production from Western Sahara.

Source: Office National des Hydrocarbures et des Mines.

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TABLE 2
MOROCCO AND WESTERN SAHARA: STRUCTURE OF THE MINERAL INDUSTRIES IN 2006

(Metric tons unless otherwise specified)

Country and commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
MOROCCO			
Arsenic trioxide	Compagnie de Tifnout Tiranimine (CTT) (Managem S.A., 55.2%, and Société Metallurgique d'Imiter, 20%)	Guemassa, Marrakech	6,100
Barite	Central d'Achat et de Développement de la Région Minière du Tafilalet et de Figuig (CADETAF) (artisanal miners)	Errachidia, Figuig, and Ouarzazate	16,000
Do.	Compagnie Marocaine des Barytes (COMABAR) [Norbar Minerals AS, 55%, and Bureau de Recherches et de Participations Minières (BRPM), 45%]	Tlet Ighoud, Safi	160,000
Do.	do.	Zelmou, Figuig	110,000
Do.	Morocco Minerals Co.	Chemaia, Safi	NA
Do.	Ouiselsat Mines S.A.	Tazzarine, Ouarzazate	NA
Do.	Société de Commerialisation et d'Exploitation Miniere d'Imoulasse (SCEMI)	NA	NA
Do.	Société Commerciale et Miniere du Sahara (SOCOMIS)	Tichka	NA
Do.	Société de Recherches et d'Exploitation Minieres Nadia	Tinitine, Marrakech	NA
Do.	Société Industrie Miniere Marocaine (IMM)	Tichka, Marrakech	NA
Do.	Société Miniere des Barytines d'Asni (SMBA)	NA	NA
Do.	Société Nord Africaine de Recherches et d'Exploitation des Mines d'Argana (SNAREMA)	Seksaoua, Marakech	120,000
Do.	Société Nouvelle Union des Metaux Maroc (SNUMM)	Jbel Abdellah, Errachidia	12,000
Do.	Société Zenaga	Tinjdad, Errachidia	NA
Barite, chemical grade	Société Nord Africaine de Recherches et d'Exploitation des Mines d'Argana (SNAREMA)	Argana	30,000
Bentonite	Société Miniere Bentonite d'Afarha S.A. [Grupo Tolsa of Spain, 80%, and Bureau de Recherches de Participations Minières (BRPM), 20%]	Aferha	9,200
Do.	Société d'Exploitation des Mines du Rif (SEFERIF) [Bureau de Recherches de Participations Minières (BRPM), 100%]	Bou Hoed, near Ouixane	15,000
Do.	Compagnie Marocaine des Barytes (COMABAR) [Norbar Minerals AS, 55%, and Bureau de Recherches de Participations Minières (BRPM), 45%]	Azzouzet-Tidiennit	5,000
Celestite	Société Karia Mines	Jbel Kifane, Taounate	NA
Cement, portland	Asment de Temara (Cimentos de Portugal, 57.4%)	Kiln and mill at Temara	845,000
Do.	Société Lafarge Ciments S.A. (Lafarge Maroc, 69.2%; general public, 12.23%; Caisse de Dépôt et de Gestion, 8.25%; Islamic Development Bank, 5.46%)	Douar Laaouameur kiln and mill south of Casablanca	2,000,000
Do.	do.	Cadem clinker mill at Meknes	1,000,000
Do.	do.	Tamuda kiln and mill, Tetouan	800,000
Do.	do.	Kiln and mill at Tangier	250,000
Do.	do.	Tetouan II kiln and mill	(1)
Do.	Société Holcim (Maroc) S.A. (Holcim Ltd. of Switzerland, 51%; general public, 35.2%; Islamic Development Bank, 13.8%)	Kiln and mill at Oujda	1,000,000
Do.	do.	Fes, Ras El Ma kiln and mill	1,200,000
Do.	do.	Fes, Doukkarat clinker mill	600,000
Do.	do.	Nador clinker mill	400,000
Do.	Société les Ciments du Maroc S.A. (CIMAR) (Ciments Français S.A., 58.3%; general public 8.97%; Caisse Interprofessionnelle Marocaine des Retraites, 7.78%; Banque Nationale pour le Developpement Economique, 5.65%; Fonds d'Abu Dhabi pour le Développement Economique Arabe, 5.38%)	Kiln and mill at Agadir	1,220,000
Do.	do.	Kiln and mill at Marrakech	1,300,000
Do.	do.	Kiln and mill at Safi	850,000
Do.	do.	Laâyoune clinker mill	350,000
Clay	Société du Ghassoul et de ses Derives SEFRIOUI SA	Tamdafelt	NA
Do.	Antonio Reyes Mine	Haddou Ammar, Nador	NA
Coal, anthracite	Charbonnages du Maroc [Bureau de Recherches de Participations Minières (BRPM), 98.89%]	Jerada[2]	650,000

See footnotes at end of table.

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TABLE 2--Continued
MOROCCO AND WESTERN SAHARA: STRUCTURE OF THE MINERAL INDUSTRIES IN 2006

(Metric tons unless otherwise specified)

Country and commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
MOROCCO--Continued				
Cobalt:				
Ore, gross weight		Compagnie de Tifnout Tiranimine (CTT) (Managem S.A., 55.2%, and Société Metallurgique d'Imiter, 20%)	Bou-Azzer, Ouarzazate	17,000
Metal		do.	Guemassa, Marrakech	1,400
Copper, concentrate		Société Minière de Bou Gaffer (SOMIFER) [Bureau de Recherches de Participations Minières (BRPM), 34.2%; Société Metallurgique d'Imiter, 36%; Managem S.A., 7.6%]	Bleida	50,000
Do.		Compagnie Minière de Guemassa (CMG) [Managem S.A., 74%, and Bureau de Recherches de Participations Minières (BRPM), 23.08%]	Douar Hajar Mine, Guemassa, Marrakech	18,000
Do.		Société de Développement du Cuivre de l'Anti-Atlas (SODECAT) [Bureau de Recherches de Participations Minières (BRPM), 100%]	Tiouit	4,500
Fluorspar, concentrate		Société Anonyme d'Entreprises Minières (SAMINE) (Managem S.A., 58%, and Société Metallurgique d'Imiter, 42%)	El Hammam, Khémisset	120,000
Gold		Akka Gold Mining Company [Managem S.A., 70%, and Bureau de Recherches de Participations Minières (BRPM), 16.07%]	Iourim, Tiznit	3
Liquefied petroleum gas	million metric tons	Société d'Exploitation des Mines du Rif (SEFERIF) [Bureau de Recherches de Participations Minières (BRPM), 100%]	Bouhoua, Nador	12
Lead:				
Concentrate		Compagnie Minière de Guemassa (CMG) [Managem S.A., 74%, and Bureau de Recherches de Participations Minières (BRPM), 23.08%]	Douar Hajar Mine, Guemassa	29,900
Do.		Compagnie Minière de Touissit (CMT) (Compagnie Royale Asturienne des Mines S.A. of Belgium, 100%)	Touissit, Jerada	73,000
Metal[2]		Société des Fonderies de Plomb de Zellidja (SFPZ) (Zellidja S.A., 50.4%)	Oued El Heimer	70,000
Manganese, concentrate		Société Anonyme Chérifienne d 'Etudes Minières (SACEM) [Bureau de Recherches de Participations Minières (BRPM), 43%, and Compagnie Minière de l'Ogooué SA (COMILOG), 30%]	Imini, Ouarzazate	14,000
Perlite		Perlite Roche [Roche Investments, 70%, and Bureau de Recherches de Participations Minières (BRPM), 20%]	Tidiennit	20,000
Do.		Perlite Inc. (Roche Investments)	Expansion plant at Berrechid, near Casablanca	NA
Petroleum, refinery products	thousand 42-gallon barrels	Société Anonyme Marocaine de l'Industrie du Raffinage (SAMIR) (Group Corral Petroleum, 64.7%, and general public, 35.3%)	Mohammedia	47,000
Do.	do.	do.	Sidi Kacem	9,500
Phosphate rock		Office Chérifien des Phosphates (OCP) (Government, 100%)	Sidi Daoui Mine, Khouribga mining center	10,000,000
Do.		do.	Mera El Arech Mine, Khouribga mining center	6,000,000
Do.		do.	Benguerir open-pit mine, Gantour mining center	4,000,000
Do.		do.	Youssoufia underground mine, Gantour mining center	3,000,000
Do.		do.	Sidi Chennane Mine, Khouribga mining center	2,000,000
Phosphoric acid, P_2O_5 content		Indio Maroc Phosphore S.A. [Office Chérifien des Phosphates (OCP), 50%, and K.K. Birla Group of India, 50%]	Jorf Lasfar	330,000
Do.		Office Chérifien des Phosphates (OCP)	Maroc Chimie I and II, Safi	270,000
Do.		do.	Maroc Phosphore I and II, Safi	1,100,000
Do.		do.	Maroc Phosphore III and IV, Jorf Lasfar	1,400,000
Phosphoric acid (purified), P_2O_5 content		Euro-Maroc Phosphore Co. [Office Chérifien des Phosphates (OCP), 33%; Société Chimique Prayon-Rupel of Belgium, 33%; Chemische Frabrik Budenheim KG of Germany, 33%)	Jorf Lasfar[3]	120,000

See footnotes at end of table.

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TABLE 2--Continued
MOROCCO AND WESTERN SAHARA: STRUCTURE OF THE MINERAL INDUSTRIES IN 2006

(Metric tons unless otherwise specified)

Country and commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
MOROCCO--Continued			
Salt:			
Rock	Société de Sel de Mohammedia (SSM) [Bureau de Recherches de Participations Minières (BRPM), 100%]	Aîn Tekki, Mohammedia	226,500
Marine	Société Chérifienne des Sels (SCS) [Bureau de Recherches de Participations Minières (BRPM), 50%; Société Nouvelle des Salins du Sine Saloum (SNSSS), 50%]	Lac Zima, Safi	30,000
Silver, ore	Société Metallurgique d'Imiter (SMI) (Managem S.A., 75.72%, and general public, 24.28%)	Near Quarzazate	525
Steel products:			
Bars and sections	Société Nationale de Sidérurgie (Sonasid) (general public, 31.14%; Société Nationale d'Ivestissement S.A., 21.07%; Axa Assurances Maroc, 8.53%; Aceralia Redendos, 8.5%)	Jorf Lasfar	300,000
Rebar and wire rod	do.	Nador	540,000
Do.	do.	Casablanca	80,000
Cold-rolled sheet	Maghreb Steel S.A.	do.	250,000
Talc and pyrophilite:			
Pyrophilite	Société Industrie Minière Marocaine (IMM)	Khenifra	NA
Talc	Société Zenaga	Tinjdad, Errachidia	NA
Do.	do.	Taliouine, Ouarzazate	NA
Zinc, concentrate	Compagnie Minière de Guemassa (CMG) [Managem S.A., 74%, and Bureau de Recherches de Participations Minières (BRPM), 23.08%]	Douar Hajar Mine, Guemassa	170,000
Do.	do.	Draa Sfar	(1)
Do.	Société des Mines de Tennous (SOMITE)	Aguerd N'Tazoult, Azilal	NA
Do.	Société Mineral et Substances	Lalla Mimouna, Taza	NA
WESTERN SAHARA			
Phosphate rock	Phosphates de Boucraa S.A. [Office Chérifien des Phosphates (OCP), 65%]	Open pit mine, Boucraa mining center	2,000,000

NA Not available.
[1]Under construction.
[2]SFPZ also refines silver and produces copper matte and sodium antimonate.
[3]A second purified phosphoric acid plant with a capacity of 120,000 metric tons per year was under construction.

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THE MINERAL INDUSTRY OF MOZAMBIQUE

By Thomas R. Yager

In 2006, Mozambique played a significant role in the world's production of aluminum, beryllium, and tantalum. The country's share of the world's tantalum mine output amounted to 6%; beryllium, 5%; and aluminum, 2%. Other domestically significant mineral processing operations included cement and natural gas (Magyar, 2007; Plunkert, 2007; Shedd, 2007).

Minerals in the National Economy

In 2004 (the latest year for which data were available), the manufacturing sector accounted for 14% of the gross domestic product, and mining and quarrying, 1.8%. The Mozal smelter accounted for about one-half of manufacturing output but had a much more modest effect on employment. The value of output in the mining sector increased by 11% in 2005 (International Monetary Fund, 2005, p. 41; Organisation for Economic Cooperation and Development, 2007, p. 393).

Production

The production of coal was estimated to have increased by 193% in 2006; granite, by 150%; garnet, 103%; diatomite, 33%; marble, 30%; cement, 29%; bauxite, 26%; dumortierite, 20%; and limestone, 15%. The production of aquamarine, beryl, niobium (columbium), tantalum, and tourmaline was estimated to have decreased by nearly 14% in 2006. In the past several years, the output of aluminum and natural gas had increased sharply.

Structure of the Mineral Industry

Most of Mozambique's mining and mineral processing operations were privately owned, including the cement plants, the Mozal aluminum smelter, and the Temane gas processing plant. Artisanal miners produced gold and aquamarine, tourmaline, and other gemstones. Carbomoc E.E., which was the country's only coal producer, was state-owned.

Commodity Review

Metals

Aluminum.—Mozambique was Africa's second ranked producer of aluminum after South Africa. The Mozal aluminum smelter, which used alumina imported from western Australia as raw material, increased output to 564,000 metric tons (t) in 2006 compared with 555,000 t in 2005. Mozal's rated capacity amounted to 506,000 metric tons per year (t/yr); BHP Billiton Ltd. planned to increase capacity by 250,000 t/yr by 2009. The expansion of Mozal depended on the negotiation of long-term power contracts (table 2; BHP Billiton Ltd., 2006, 2007; Organisation for Economic Cooperation and Development, 2007, p. 393, 398-399).

In the first six months of 2006, aluminum exports were valued at $637.8 million compared with $504.2 million during the same period in 2005. The share of aluminum in total exports, however, declined to 57% from 63% as other exports increased at a faster rate.

E.C. Meikles (Pty.) Ltd. of Zimbabwe operated a small bauxite mine in Manica Province. In 2006, output increased by an estimated 26%; production was expected to rise by an additional 10% in 2007 (Government of Mozambique, 2007, p. 17).

Gold.—Small amounts of gold were produced by artisanal miners. Pan African Resources plc of the United Kingdom was considering the development of a mine at the Fair Bride deposit on its Manica gold project. The mine would produce an average of 2,600 kg/yr during an expected mine life of between 8 and 9 years. Pan African planned to start drilling in the first quarter of 2007 (Pan African Resources plc, 2006).

Iron and Steel.—In October 2006, Mittal Steel South Africa Ltd. agreed to purchase the assets of Companhia Siderugica de Mozambique (CSM) and Companhia Mozambique de Trefiloria (Trefil) for $11.45 million. Mittal stated that production of steel rods at CSM and wire and nails at Trefil could restart by April 2007; the company planned to invest an additional $10 million to reopen the plants (Mozambique News Agency, 2006).

Niobium (Columbium) and Tantalum.—National production of tantalite was estimated to be 240,000 kilograms (kg) in 2006 compared with 281,212 kg in 2005. Fleming Family & Partners owned a majority stake in the Marropino Mine through Highland African Mining Company (HAMC). The company was unable to produce at Marropino until the fourth quarter of 2006 because of financial and technical problems. HAMC also held a license to produce tantalite from the Morrua Mine, which had been shut down since the 1980s. If the Morrua Mine were reopened, it could produce as much as 230,000 kilograms per year (kg/yr) of tantalum pentoxide (Ta_2O_5) (Sunday Times, 2005; Mozambique News Agency, 2007).

TAN Mining and Exploration of South Africa had planned to reopen the Muiane Mine in mid-2005 at a cost of $5 million. The company had planned to produce 82,000 kg/yr of Ta_2O_5 in concentrate from 420,000 t/yr of ore; the tantalite recovery rate would be about 60%. By the end of 2006, production had not restarted at Muiane, however, and TAN's lease was awarded to HAMC because the former company reportedly violated clauses in its contract with the Government (Mining Review Africa, 2005; Mozambique News Agency, 2007).

Industrial Minerals

Cement.—Cimentos de Mocambique SARL (Cimentos de Portugal, SGPS, SA (Cimpor), 65.4%) produced cement at its Dondo, Matola, and Nacala plants. ARJ Group opened a cement plant at Nacala in mid-2005. In 2005 and 2006, Cimpor's production was reduced by operational problems at the Matola

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plant; the kiln was shut down for two months in 2006 to install and repair environmental protection equipment (Cimentos de Portugal, SGPS, SA, 2007, p. 68-69).

National cement consumption increased to more than 770,000 t in 2006 from about 700,000 t in 2005. Cimpor's market share declined to 78% in 2006 from 83% in 2005. Before 2005, Cimpor's sales were from domestic production; the problems at the Matola plant, however, forced the company to import cement (Cimentos de Portugal, SGPS, SA, 2007, p. 68-69).

Clay and Shale.—Small amounts of bentonite were produced at Mafuiane in the Namaacha District. Production was inhibited by high transportation costs.

Gemstones.—Aquamarine, morganite, tourmaline, and other gemstones were mined in Zambezia Province; dumortierite, in Tete Province; and garnet, in Niassa Province. The mine output of garnet doubled to an estimated 4,400 kg in 2006; the increase may have been attributable to upgrades to the Cuamba Mine by Sociedade Mineira de Cuamba E.E. Garnet production was expected to increase by 26% in 2007. The production of dumortierite declined sharply in 2005 because of poor market conditions and a lack of equipment. In 2007, production was expected to increase by 10% compared with an estimated 20% in 2006. Copper-containing tourmaline was mined from an alluvial deposit in the Alto Ligonha District of Zambezia Province starting in early 2004; the mines were still producing at the end of 2006 (Government of Mozambique, 2007, p. 17-18; Wise, 2007).

Titanium and Zirconium.—BHP Billiton was conducting a review and update of previous feasibility studies on its Corridor Sands Project, which was based upon 10 deposits of heavy-mineral sands near Chibuto in southern Mozambique. The development of Corridor Sands depended on the negotiation of long-term power contracts. BHP Billiton was also considering the development of the TiGen mineral sands project at Moebase (Organisation for Economic Cooperation and Development, 2007, p. 398-399).

Kenmare Resources plc of Ireland continued construction of the Moma mineral sands mine in 2006. The company planned to start mining in early 2007; the initial rate of ilmenite production was expected to be 700,000 t/yr. In the second half of 2007, Kenmare planned to complete an expansion to increase ilmenite production to 800,000 t/yr in 2008; the output of zircon would be 56,000 t/yr, and rutile, 21,000 t/yr (Industrial Minerals, 2006).

Mineral Fuels and Related Materials

Coal.—Companhia Vale do Rio Doce (CVRD) of Brazil completed a feasibility study on the development of the Moatize coalfield in 2006; the company planned to make its final decision about the project in 2007. If CVRD were to decide to proceed, the Moatize Mine was expected to produce 9 million metric tons per year (Mt/yr) of coking coal and 3.5 Mt/yr of thermal coal starting as early as 2010. The coaking coal was likely to be consumed by steel plants in Brazil; thermal coal would be consumed by a new coal-fired power station built by CVRD in Mozambique with a capacity of 1,500 megawatts (Mozambique News Agency, 2004; Mining Journal, 2006).

Development of the Moatize Mine depended on rehabilitation of the railway from Beira to Tete, and the construction of a maritime export terminal at Beira. Total costs of the project were estimated to be $2 billion. Ircon International of India and Rites Ltd. of India were engaged in rebuilding the 650-kilometer (km) rail line from Beira to Tete, which linked the Moatize Mine to the Port of Beira. Rehabilitation was expected to be completed in early 2009 (Mozambique News Agency, 2004; Mining Journal, 2006).

Central African Mining and Exploration Company plc explored at its properties in the Moatize coalfield in 2006; the company also held properties in the Mucanha-Vuzi coalfield. Riversdale Mining Ltd. of Australia acquired exploration licenses in the Moatize coalfield in the first quarter of 2006 (Central African Mining and Exploration Company plc, 2006, p. 6).

Natural Gas.—Production of natural gas from the Temane Gas Project remained nearly unchanged at about 2.33 billion cubic meters in 2006. Sasol Ltd. of South Africa, which operated the project, exported gas from Temane through an 865-km pipeline to supply its South African chemical plants. In 2006, Sasol operated at 75% of capacity; the company planned to reach full capacity by June 2008. Higher production would be attributable to the development of the Pande gasfield by the end of 2007 (table 2; Sasol Ltd., 2006, p. 49, 65).

Sasol engaged in exploration in its onshore properties and planned to start exploration at offshore Blocks 16 and 19 in 2007. The company planned a possible further increase in production capacity by 2012 to 6.2 billion cubic meters per year from 3.1 billion cubic meters per year; this increase would depend on the results of its exploration activities (Sasol Ltd., 2006, p. 49, 65).

Petroleum.—Mozambique produced neither crude petroleum nor refined petroleum products and relied on imports. In early 2006, the Onshore Area in the Rovuma Basin was awarded to Artumas Group Inc. of Canada; Area 1, to Anadarko Petroleum Corp. of the United States; Areas 2 and 5, to Norsk Hydro ASA of Norway; Areas 3 and 6, to Petronas Carigali Overseas Shd. Bhd. of Malaysia; and Area 4, to ENI S.p.A. of Italy (National Institute of Petroleum, 2006).

Uranium.—The Mavuzi Mine in northwestern Mozambique produced uranium during the 1950s. OmegaCorp Ltd. of Australia conducted an exploration project at Mavuzi in late 2005 and 2006; the company planned a small-scale drill program for 2007 (Resource Information Unit, 2007).

Outlook

The Moma Mine was likely to increase economic growth in 2007; the outlook for titanium minerals in Mozambique depended heavily upon global market trends. The Moatize coal mine could boost economic growth in 2010; the development of the mine depended upon global market trends and the rehabilitation of rail and port infrastructure. Development of the Corridor Sands and the Mozal 3 projects depended upon reliable power supplies. Demand for construction materials could increase in 2007 because of public works projects; the development of the Corridor Sands, Moatize, and Mozal 3

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projects could also lead to growth in the construction sector. In 2007, the production of limestone was expected to increase by 58%; marble slabs, 20%; sand, 9%; and marble blocks, 5% (Government of Mozambique, 2007, p. 17).

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TABLE 1
MOZAMBIQUE: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004	2005	2006[e]
Aluminum:						
Bauxite		9,119	11,793	6,723	9,518	12,000
Metal, refined		273,000	407,000	549,000	555,000	564,000 [3]
Beryl	kilograms	54,300	78,300	45,200	146,300	130,000
Cement, hydraulic	thousand metric tons	490 [r]	600 [r]	570 [r]	560 [r]	720
Clays:						
Bentonite:						
Crude		--	--	3,336	--	--
Processed		580	684	578	547	610
Brick		84,024	100,176	108,231	32,031	32,000
Coal, bituminous		43,512	36,742	16,525	3,417	10,000
Diatomite		--	--	3,000 [e]	4,500 [e]	6,000
Gemstones:						
Aquamarine	kilograms	26	8	18	16	14
Dumortierite		40	65	113	10	12
Garnet	kilograms	1,136	440	2,686	2,172	4,400
Tourmaline	do.	124	581	1,570	245	210
Gold[4]	do.	17	63	56	63	68
Natural gas	million cubic meters	2	1	1,295	2,316	2,330
Niobium (columbium) and tantalum, columbite-tantalite, ore and concentrate:						
Gross weight	kilograms	46,900	188,695	712,095	281,212	240,000
Nb content[e]	do.	5,500	23,000	87,000	34,000	29,000
Ta content[e]	do.	13,000	54,000	205,000	81,000	70,000
Quartz	do.	31,363	30,985	173,478	--	--
Salt, marine[e]		80,000	80,000	80,000	80,000	80,000
Sands	cubic meters	795,813	1,372,032	1,429,743	833,113	860,000
Stone:						
Granite	do.	670	539	521	2,198	5,500
Gravel and crushed rock	do.	795,733	740,501 [r]	779,581 [r]	850,919 [r]	880,000
Limestone		1,301,232	1,348,372	1,593,450	654,179	750,000
Marble:						
Block	cubic meters	453	452	617	509	630
Slab	square meters	9,980	10,227	13,666	12,318	16,000

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised. -- Zero.

[1]Table includes data available through June 9, 2007.

[2]Other such gemstones as morganite were produced, but information is insufficient to estimate production.

[3]Reported figure.

[4]Does not include unreported production; total output of gold was estimated to be roughly 600 to 900 kilograms per year.

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TABLE 2
MOZAMBIQUE: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity[1]
Aluminum		Mozal SARL (BHP Billiton Ltd., 47%)	Maputo	506,000.
Bauxite		E.C. Meikles (Pty) Ltd. of Zimbabwe	Monte Snuta	12,000.[e]
Bentonite		Cia Desenvolvimento Mineira[2]	Boane	30,000.
Cement		Cimentos de Mocambique, SARL (Cimentos de Portugal, SGPS, SA (Cimpor), 65.4%)	Dondo, Matola, and Nacala	745,000.
Do.		ARJ Group	Nacala	250,000.
Coal, bituminous		Carbomoc	Chipanga XI Mine at Moatize	60,000.
Garnet	kilograms	Sociedade Mineira de Cuamba EE	Cuamba	4,400.[e]
Gold	do.	Artisanal miners	Manica District	600.
Graphite		Kenmare Resources plc[3]	Ancuabe	10,000.
Marble, block	cubic meters	Marmonte E.E.	Montepuez	1,500.
Natural gas	million cubic meters	Sasol Ltd. (50%)	Temane	3,100.
Niobium (columbium) and tantalum, columbite-tatalite, ore and concentrate	kilograms	Fleming Family & Partners	Marropino	315,000[e] concentrate; 110,000 Ta_2O_5; 47,000 Nb_2O_5.[e]
Do.	do.	Central African Mining and Exploration Company plc (CAMEC)	Zambezia Province	155,000 concentrate; 54,000 Ta_2O_5.
Do.	do.	Hegemony Resources	Naquissupa	NA.

[e]Estimated; estimated data are rounded to no more than three significant digits. NA Not available.
[1]Abbreviations used in this table for commodities include the following: Nb_2O_5--columbium (niobium) oxide; and Ta_2O_5--tantalum oxide.
[2]Not operating in 2006.
[3]On care and maintenance since 1999.

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The Mineral Industry of Namibia

By Philip M. Mobbs

Diamond remained the most economically significant mineral commodity produced by the mining industry of Namibia. The country produced about 2% of the world's gem-quality diamond, which placed it as the eighth ranked producer of gem diamond in terms of value. Namibia, which is located on the southwestern coast of Africa, also was the sixth ranked producer of uranium, producing about 8% of the world's uranium in 2006 (World Nuclear Association, 2007; Olson, 2008).

Namibia's mining industry is regulated by the Diamond Act, 1999; the Minerals (Prospecting and Mining) Act, 1992; and the Minerals Development Fund of Namibia Act of 1996. The petroleum sector is governed by the Petroleum (Exploration and Production) Act, 1991; the Petroleum (Taxation) Act, 1991; the Petroleum (Exploration and Production) Amendment Act, 1993; the Petroleum Laws Amendment Act, 1998; the Model Petroleum Agreement, 1998; and the Petroleum Products and Energy Amendment Act, 2000.

In 2006, the Government confirmed a royalty schedule that originally had been introduced in 2004. A 3% royalty was levied on the market value of base, precious, and rare metals and nonnuclear mineral fuels. A 2% royalty was levied on industrial minerals and nuclear mineral fuels.

Minerals in the National Economy

Diamond mining contributed about 8.6% to the gross domestic product (GDP) of Namibia; construction accounted for 3.7% of the GDP, and other mining and quarrying, 3.1%. Mineral exports accounted for a significant segment of trade and foreign exchange earnings (Bank of Namibia, 2007).

Production

In 2006, manganese, diamond, and fluorspar output increased by 158%, 24%, and 15%, respectively, compared with that of 2005, and copper, lead, wollastonite, and zinc posted significant production declines. The increase in manganese was attributable to the expansion of production at the reopened Purity Mine (formerly the Otjisondu Mine). The decline in copper output could be attributed in part to instability during the transition of ownership of Ongopolo Mining and Processing Ltd. Lead and zinc output declined in part because of a short strike by workers at the Rosh Pinah Mine. Data on mineral production are provided in table 1.

Structure of the Mineral Industry

The Government encourages private sector exploration and development according to guidelines set out in its 2003 paper entitled "The Mineral Policy of Namibia." The Ministry of Mines and Energy and its Diamond Affairs, Energy, and Mining Directorates regulate Namibia's mining and petroleum industries, and the Ministry concerns itself with the provision of national exploration and mining databases and competitive exploration and mining policy and regulations. The Ministry of Trade and Industry is responsible for regulating manufacturing activity, which includes mineral beneficiation, the production of cement, and the processing of semiprecious stones; the Ministry also promotes resource-based development.

The larger mining operations in Namibia tended to be funded and operated by domestic and international investors. Numerous local operations were involved in smaller-scale industrial mineral production, especially the semiprecious gemstone sector.

Commodity Review

Metals

Copper.—In 2006, Weatherly International plc of the United Kingdom agreed to acquire 56% interest in financially-distressed Ongopolo; Weatherly subsequently increased its equity interest in the company to 100%. Ongopolo operated the Kombat, the Matchless, and the Otjihase Mines. Ongopolo suspended operations at the Tsumeb copper smelter in mid-2006, relined the 30,000-metric-ton-per-year (t/yr)-capacity reverberatory furnace, and reopened the smelter in August. A second reverberatory furnace at Tsumeb remained inactive, pending renovation (Weatherly International plc, 2006).

Ongopolo evaluated the development of an underground mine at the Tschudi copper-silver prospect. Other copper exploration activity in Namibia included that of Copper Resources Corp. of South Africa on the Haib project, Helio Resource Corp. of Canada on the Honib prospect, Teck Cominco Ltd. of Canada on the Kaoko project, and Yale Resources Ltd. of Canada on the Leicester prospect.

Gold.—Companies that explored for gold in 2006 included Forsys Metals Corp. of Canada on the Ondundu prospect, Teal Exploration & Mining Inc. of Canada on the Otjikoto prospect, and Teck Cominco on the Vredelus prospect. Yale Resources worked on the Makuru (also known as the Otjimakuru) project.

Lead and Zinc.—Contributing to the decline in Namibian zinc output in 2006 was the nearly 3-week fire-related suspension of zinc metal production operations at the Skorpion zinc facility and a strike at the Rosh Pinah Mine for higher wages, which lasted for about 2 weeks and adversely affected lead and zinc concentrate production. Kumba Resources Ltd. of South Africa proposed to reduce its 89.5% equity interest in Rosh Pinah to about 50%. A local investor group, which included PE Minerals (Namibia) (Pty.) Ltd., was expected to acquire Kumba's divested interest (Bloomberg.com, 2006; Reuters, 2006).

Industrial Minerals

Cement.— Cement had been imported since the closure of the Otjiwarongo factory of African Portland Cement several years ago. Holcim (Namibia) (Pty.) Ltd., which was owned

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by Holcim S.A. of Switzerland, 54%, and the Aveng Group of South Africa, 46% (and known as Alpha Cement prior to 2004), imported about 25,000 metric tons per month of cement to meet local demand.

In 2005, Cheetah Cement Factory, which was a joint venture of Whale Rock Cement of Namibia and CP Cimento e Participacoes S.A. of Brazil, proposed to import cement from Brazil until a 500,000-t/yr-capacity cement plant near Otjiwarongo was built. In late 2005, Cheetah Cement imported 36,000 metric tons (t) of cement from Brazil, but most of the cement was lost when Cheetah Cement's warehouse was flooded in early 2006. As a result, planning for the construction of the new cement factory was suspended (Namibian Economist, The, 2007).

Diamond.—Namdeb Diamond Corp. (Pty.) Ltd., which was a joint venture between De Beers Centenary AG and the Namibian Government (50% each), was the country's leading diamond producer. During 2006, Namdeb, its contractors, and its subsidiaries produced more than 2 million carats. The partners also negotiated the Namdeb Sales Agreement in 2006, which created the Namibia Diamond Trading Co., to sort and value the volume of Namdeb's production that would be marketed to the domestic diamond-cutting industry (Namdeb Diamond Corp. (Pty.) Ltd., 2007, p. 6, 14, 16).

Mineral Fuels and Related Materials

Petroleum.—Offshore petroleum activity included exploration on Block 1711 by the joint venture of Z.A.O. Sintezneftegas of Russia (70%), Petroleum, Oil & Gas Corp. of South Africa (PetroSA) (10%), EnerGulf Resources Inc. of the United States (10%), and the National Petroleum Corp. of Namibia (NAMCOR) (7%). Onshore exploration included that of the joint venture of Circle Oil Namibia Ltd. (90%) and NAMCOR (10%). In 2006, Mitusi Atlantic Energy BV (15%) joined the joint venture of BHP Billiton Ltd. of Australia (75%) and PetroSA (10%), which held Blocks 2813A, 2814B, and 2914.

Uranium.—Rössing Uranium Ltd. processed about 12 million metric tons of ore in 2006 and produced 3,617 t of U_3O_8. Production was exported to the Asia and the Pacific, the European, and the North American markets by Rio Tinto Uranium; Rössing shareholders had no offtake rights.

Earlier this decade, Rössing had announced that the Rössing Mine would be closed in 2009. By 2005, the increase in the world market price of uranium allowed Rössing to plan to extend operations to 2016. In 2006, positive exploration results and continued favorable uranium market conditions allowed Rössing to propose that the mine's life could be extended to 2021 (Rössing Uranium Ltd., 2007a, b).

In late 2006, Paladin Resources Ltd. commissioned the Langer Heinrich uranium oxide (U_3O_8, or yellowcake) plant; startup output was not included in the country's 2006 production data. Paladin expected to ramp up U_3O_8 production to about 1,180 t/yr (2.6 million pounds per year) (Paladin Resources Ltd., 2006).

Exploration activity and evaluation of uranium mineralization in Namibia in 2006 included that of Bannerman Resources Ltd. of Australia on the Goanikontes and Swakop River prospects, Extract Resources Ltd. of Australia on the Husab project, Forsys Metals on the Valencia project, Metals Australia Ltd. of Australia (formerly Australian United Gold Ltd.) on the Engo Valley and Mile 72 projects, Rössing Uranium on the SH and SK anomalies on Rössing's mining lease near Arandis, UranMin Inc. on the Trekkopje deposit, and Western Australian Metals Ltd. of Australia on the Marinica project. In early 2006, Xemplar Energy Corp. of Canada acquired Namura Minerals Resources (Pty.) Ltd., which held the Aus, the Cape Cross, and the Warmbad uranium projects. Namura subsequently acquired a reconnaissance license in the Engo Valley area.

Outlook

The long tradition of mining in Namibia has been renewed with the reopening of the Tsumeb-area copper mines and smelter, the opening of the Skorpion zinc project, the expansion of the fluorspar and the gold mines, and the continued offshore diamond development of the past few years. Extensive exploration in Namibia for base metals, diamond, gold, natural gas, and uranium has been attributed, in part, to the rise in world commodity prices. Potentially new mine development and new value-added gemstone cutting and polishing, metal-processing, and other mineral-based manufacturing industries could maintain the mineral sector's position as a significant segment of the economy of Namibia for the foreseeable future.

With a climate that is among the driest in the world, the lack of water resources will continue to be a constraint on mineral development in Namibia, as will the availability of fuel and electric power. New investment to develop the country's natural gas resources and harness the hydroelectric power potential, and the recently proposed (2006) introduction of nuclear-powered electricity-generating plants, will influence the future economic growth of Namibia. The expansion of regional transportation infrastructure in northern Namibia could see the Port of Walvis Bay become an alternative route for mineral exports from southeastern Angola, Botswana, and Zambia.

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TABLE 1
NAMIBIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2002	2003	2004	2005	2006[p]
METALS						
Arsenic, white, 99% arsenic trioxide		880	389	1,264	89	-- [e]
Copper:						
Mine output, concentrate (26% – 30% Cu):						
Gross weight		63,997	64,882	58,792	40,542	25,000 [e]
Cu content		18,012	16,175	11,174	10,157	6,262
Metal, blister:						
From domestic concentrates[e]		17,850 [2]	16,106 [2]	11,000 [r]	10,000 [r]	6,200
From imported toll concentrates[e]		8,853 [2]	9,930 [2]	13,700 [r]	13,600 [r]	15,700
Total		26,703 [2]	26,036 [2]	24,704	23,551	21,918
Gold	kilograms	2,815	2,508	2,205	2,703	2,790
Lead, mine output, concentrate:						
Gross weight		24,140	31,453	27,338	24,689	21,402
Pb content of Pb and Pb-Zn concentrates		13,809	18,782	14,338	14,320	11,830
Manganese		--	--	--	7,320	18,918
Silver:						
Mine output, Ag content of concentrate	kilograms	43,632	45,100	27,153	30,003	31,307
Metal, refined, primary[3]	do.	12,020	18,140	14,815	15,000	15,000
Tantalite:						
Gross weight, concentrates[e]		23	100	30	--	--
Ta content (36%)		8	36	11 [e]	--	--
Tin:						
Gross weight, concentrates		--	72	25 [e]	--	--
Sn content (60%)		--	43	15 [e]	--	--
Uranium, U_3O_8		2,751	2,401	3,583	3,711	3,617
Zinc:						
Gross weight, mine output, concentrate (49% – 56% Zn)		77,587	107,920	123,372	126,123	100,000 [e]
Zn content of Zn and Pb-Zn concentrates[4]		42,685	60,500	66,028	69,368 [r]	55,455 [e]
Metal, refined, primary[3]		35	47,436	120,533	132,818	129,897
INDUSTRIAL MINERALS						
Diamond, gem	thousand carats	1,562	1,481	2,004	1,902	2,356
Fluorspar, acid grade (97% $CaFl_2$)[5]		81,084	79,349	104,785	114,886 [r]	132,249
Salt		630,159	697,914	754,351	573,248	603,501
Semiprecious stones:						
Agate		190	123	158	150 [e]	150 [e]
Amethyst[e]	kilograms	4,500	300 [2]	41,367 [2]	40,000	40,000
Blue chalcedony[e]	do.	NA	124 [2]	69 [2]	50	50
Chrysocolla[e]	do.	13 [2]	--	--	--	--
Garnet[e]	do.	150	--	115 [2]	100	100
Picture stone[e]		NA	326 [2]	240 [2]	200	200
Pietersite[e]		--	11 [2]	9 [2]	--	--
Rose quartz[e]		--	93 [2]	--	--	--
Sodalite[e]		1,691 [2]	174 [2]	--	--	--
Tourmaline[e]	kilograms	--	218 [2]	102 [2]	100	100
Stone:						
Dolomite		--	15,401	13,536	14,000 [e]	14,000 [e]
Granite		24,754	27,456	25,492	21,380	21,000 [e]
Marble		3,182	4,523	8,356	5,112	5,100 [e]
Sodalite		NA	704	138	100	100 [e]
Sulfur, pyrite concentrate:						
Gross weight (49% – 51% S)		3,633	31,786	3,658	1,035	-- [e]
S content		1,874	16,390	1,835	520	-- [e]
Wollastonite		742	585	406	253	55

See footnotes at end of table.

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TABLE 1--Continued
NAMIBIA: PRODUCTION OF MINERAL COMMODITIES[1]

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. NA Not available. [p]Preliminary. [r]Revised. --Zero.
[1]Table includes data available through November 14, 2007.
[2]Reported figure.
[3]Includes products of imported concentrate.
[4]Ore from the Skorpion Mine is leached onsite; the zinc is recovered by solvent extraction-electrowinning and is thus not included in the zinc concentrate data.
[5]Fluorspar production shown in wet metric tons; approximately 9% moisture.

TABLE 2
NAMIBIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Copper:				
Cu content of concentrates		Ongopolo Mining and Processing Ltd. (Weatherly International plc, 100%)	Central operations, includes the Otjihase Mine and concentrator, about 30 kilometers north of Windhoek; and the Matchless Mine, 80 kilometers southwest of the Otjihase Mine	23,000
Do.		do.	Kombat operations, includes Kombat Mine and concentrator, 440 kilometers north of Windhoek	9,000
Metal, blister copper		do.	Smelter at Tsumeb	30,000
Diamond	carats	Namdeb Diamond Corp. (Pty.) Ltd. (Government, 50%, and De Beers Centenary AG, 50%)	Mining Area 1, from Orange River to 145 kilometers north of Orangemund, includes Pocket Beaches	1,000,000
Do.	do.	do.	Northern Areas and Elizabeth Bay Mines, 24 kilometers south of Luderitz	180,000
Do.	do.	do.	Orange River Mines, from mouth of Orange River east to Sendelingsdrif; includes the Auchas and the Daberas Mines	120,000
Do.	do.	do.	Beach and marine contractors	35,000
Do.	do.	De Beers Marine Namibia [De Beers Centenary AG, 70%, and Namdeb Diamond Corp. (Pty.) Ltd., 30%]	Atlanta 1 license area, offshore Sperrgebiet	1,020,000
Do.	do.	Sakawe Mining Corp. (LL Mining Corp. BV)	Twenty-two offshore mining licenses, near Luderitz Bay	225,000
Do.	do.	Joint venture of Diamond Fields (Pty.) Ltd. of Namibia (Diamond Fields International Ltd., 100%), and Bonaparte Diamond Mines NL	Mining License 111, offshore Luderitz	NA
Do.	do.	Diaz Exploration (Pty.) Ltd.	Offshore operation	15,000
Fluorspar, acid grade		Okorusu Fluorspar (Pty.) Ltd. (Solvay Fluor GmbH, 100%)	Mine and plant at Okorusu	105,000
Gold:				
Ore	kilograms	AngloGold Ashanti Namibia (Pty.) Ltd.	Navachab Mine, 170 kilometers northwest of Windhoek	2,700
Metal	do.	Ongopolo Mining and Processing Ltd. (Weatherly International plc, 100%)	Copper smelter at Tsumeb	400
Lead, Pb content of concentrate		Rosh Pinah Zinc Corp. (Pty.) Ltd. [Kumba Resources Ltd., 89.5%, and PE Minerals (Namibia) (Pty.) Ltd., 6.1%]	Rosh Pinah Mine, near Rosh Pinah	20,000
Pyrite, concentrate		Ongopolo Mining and Processing Ltd. (Weatherly International plc, 100%)	Ojithase Mine and concentrator, near Tsumeb	32,000

See footnotes at end of table.

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TABLE 2--Continued
NAMIBIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Salt	Salt & Chemicals (Pty.) Ltd. [Walvis Bay Salt Holdings (Pty.) Ltd., 100%]	Salt pan at Walvis Bay	650,000
Do.	Walvis Bay Salt Refiners (Pty.) Ltd. [Walvis Bay Salt Holdings (Pty.) Ltd., 100%]	Salt refinery at Walvis Bay	650,000
Do.	Salt Company (Pty.) Ltd.	Swakopmund	120,000
Do.	Cape Cross Salt (Pty.) Ltd.	North of Henties Bay	40,000
Silver:			
Concentrate, Ag content	Rosh Pinah Zinc Corp. (Pty.) Ltd. [Kumba Resources Ltd., 89.5%, and PE Minerals (Namibia) (Pty.) Ltd., 6.1%]	Rosh Pinah Mine, near Rosh Pinah	25
Metal	Ongopolo Mining and Processing Ltd. (Weatherly International plc, 100%)	Coproduct of copper smelter at Tsumeb	23
Uranium, uranium oxide	Rössing Uranium Ltd. (Rio Tinto Group, 68.6%; Government of Iran, 15%; Industrial Development Corp. of South Africa Ltd., 10%; Government of Namibia, 3.5%)	Rössing Mine, 65 kilometers northeast of Swakopmund	4,800
Do.	Langer Heinrich Uranium (Pty.) Ltd. (Paladin Resources Ltd., 100%)	Langer Heinrich Mine. 80 kilometers east of Walvis Bay	1,180
Wollastonite	Namibia Mineral Development Co. (Pty.) Ltd.	Usakos Mine	800
Zinc:			
Mine:			
Concentrate, Zn content	Rosh Pinah Zinc Corp. (Pty.) Ltd. [Kumba Resources Ltd., 89.5%, and PE Minerals (Namibia) (Pty.) Ltd., 6.1%]	Rosh Pinah Mine, near Rosh Pinah	110,000
Ore	Skorpion Mining Co. (Pty.) Ltd. (Anglo American plc, 100%)	Skorpion Mine, 25 kilometers north of Rosh Pinah	1,500,000
Metal	Namzinc (Pty.) Ltd. (Anglo American plc, 100%)	Skorpion solvent extraction facilities and electrowinning refinery, 25 kilometers north of Rosh Pinah	150,000

[e]Estimated; estimated data are rounded to no more than three significant digits. NA Not available.

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The Mineral Industry of Nigeria

By Philip M. Mobbs

As Africa's leading petroleum (crude oil) producer and a member of the Organization of the Petroleum Exporting Countries (OPEC), Nigeria accounted for about 25% of African crude oil production and about 3% of total world production. In 2006, Government revenue from hydrocarbons increased to $41 billion[1] compared with $35.6 billion in 2005. Because crude oil production declined in 2006, the growth of Government hydrocarbon revenues was the result of the rise in international oil prices. The average price of Bonny Light, which is a standard Nigerian crude-oil-reference-type, rose to $66.46 per barrel in 2006 compared with $55.43 in 2005. Some of the increase in oil prices worldwide in 2006 was attributable to the civil turmoil in southern Nigeria, which introduced additional uncertainty into the world supply of crude oil (BP p.l.c., 2007, p. 8; Central Bank of Nigeria, 2007, p. 59-60, 81, 206, 260).

Under the Mining and Minerals Decree (law No. 34 of 1999), the Federal Government holds all mineral rights. By early 2006, the Ministry of Solid Minerals Development (MSMD) completed the revalidation of 1,450 mining licenses, of which 33 were provisional approvals. The revalidation program, which started in 2005, updated and verified the national mining title registry. Subsequently, the Mining Cadastre Office, which was established to process mining licenses, was opened.

At the beginning of the year, the MSMD had reduced its primarily administrative staff to 328 people from 1,303 to allow the transformation of the Ministry to a more technically oriented agency. The Government released the Federal Executive Council's policy document "Development of a Policy on Solid Minerals Development" and declared that solid minerals formed a strategic sector of the national economy. Also in 2006, the Geological Survey of Nigeria Agency was renamed the Nigerian Geological Survey Agency, the governing board of the Nigeria Nuclear Regulatory Authority was inaugurated, and the development of new minerals and mining legislation continued.

The Petroleum Act of 1969 formed the legal basis for activity in the upstream petroleum sector. Other legislation that regulated the petroleum sector included the Oil Pipelines Act of 1956 and amendments, the Hydrocarbon Oil Refineries Act of 1965, the petroleum (drilling and production) regulations of 1969 and the 1990 amendment, the petroleum (refining) regulations of 1974 and 1977, the Associated Gas Re-Injection Act of 1979 and amendments, the Federal Environmental Protection Agency Act of 1988, the Nigeria LNG Decree of 1990, and the Petroleum Profits Tax Act of 2004.

Minerals in the National Economy

Crude oil and natural gas activity accounted for about 50% of the Nigerian gross domestic product. In 2006, total official exports were provisionally valued at about $45 billion, of which the value of exported crude oil (which totaled about 652 million 42-gallon barrels) was estimated to be $43.3 billion. The value of crude oil exports in 2005, which totaled about 824 million barrels, was revised to $47.2 billion. The 8% decline in the value of exported oil in 2006 compared with that of 2005 was attributed to the 20.9% decline in the volume of crude oil exports, which was partially offset by the rise in international oil prices. Of the total official crude oil exports from Nigeria in 2006, the United States imported 47%; India, 12%; Spain, 4.1%; Côte d'Ivoire, 3.9%; and Brazil, 3.8% (Central Bank of Nigeria, 2007, p. 251, 256).

The value of natural gas exports was estimated to be $796 million in 2006, which was a significant increase from the $456 million reported in 2005. Exports of aluminum semimanufactured products were valued at about $60 million, and exports of steel, $2 million (Central Bank of Nigeria, 2007, p. 251, 258-259).

Production

The ramp-up of liquid steel production by Delta Steel Co. Ltd. significantly increased national steel output. Notable production increases also were estimated for cement and were reported for limestone, which was used by the cement producers (Central Bank of Nigeria, 2007, p. 83).

The 11.9% decline in crude oil production compared with that of 2005 is attributable to the civil and criminal violence directed at the international oil company facilities; intertribal conflicts in the Niger Delta region that adversely affected production operations; repeated vandalism of domestic crude oil, natural gas, and petroleum products pipelines; and a reduction in the OPEC crude oil production ceiling allocation (quota) of 100,000 barrels per day (bbl/d) that became effective in November 2006. The Government estimated that Nigeria lost revenues of $4.47 billion because of the civil unrest in 2006 (Nwanma, 2007).

The swings in refined oil production between 2002 and 2006 were attributed to Kaduna Refinery and Petrochemicals Co. Ltd. and Warri Refinery and Petrochemicals Co. Ltd., which operated intermittently in 2006 after vandalism shut down the pipelines that supplied crude oil to the refineries in February. The crude oil supply to the Kaduna and the Warri refineries also had been adversely affected by pipeline breaches in 2003 and 2004 (Platts, 2006b).

The significant increase in revenue from natural gas exports in 2006 is attributable to the sales of output from the new liquefied natural gas (LNG) process lines (trains) 4 and 5 of the Nigeria Liquefied Natural Gas Ltd. (NLNG) facility at Finima on Bonny Island. The two new trains increased the plant's capacity to 17.05 million metric tons per year (Mt/yr), which nearly doubled the country's LNG production capacity (Infrastructure Journal, 2006).

[1]Where necessary, values have been converted from Nigerian naira (₦) to U.S. dollars (US$) at the average rates of ₦128.65=US$1.00 for 2006 and ₦131.66=US$1.00 for 2005.

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Structure of the Mineral Industry

In 2006, the MSMD managed much of the solid minerals sector. The Ministry of Power and Steel was responsible for the coal, iron, and steel sectors, and the Ministry of Industry managed the cement sector. The combination of the solid mineral development functions of MSMD and the coal, iron, and steel responsibilities of the Ministry of Power and Steel was expected in early 2007.

In recent years, the Government had privatized many of the large previously state-owned minerals companies by selling equity interest to private investors. The Government sold off management rights for some of the state-owned companies that were not privatized. The management rights to two state-owned companies in the iron and steel sector, Ajaokuta Steel Co. Ltd. and National Iron Ore Mining Co., for example, were awarded to Global Steel Holdings Ltd. (also known as Global Infrastructure Holdings Ltd.) under 10-year concessions. Global Steel also held majority equity interest in Delta Steel, which operated Nigeria's other steel plant.

The privatization of segments of National Mining Corp. proceeded in 2006; initial bids were opened at midyear. Emo Ashapura Energy & Mining Ltd. acquired the five cassiterite and kaolin mining leases in Plateau State, which formerly were held by Nigeria Kaolin Ltd., and Barite Mining Lease 18706 in Nasarawa State, which formerly was held by Nigerian Barytes Mining and Processing Co. Ltd. Equator Mines Ltd. of Nigeria acquired 72 mining licenses formerly held by Nigerian Tin and Allied Minerals Product Ltd. in Bauchi and Kaduna States. Livingspring Mineral Promotion Co. Ltd. of Nigeria acquired three mining leases in the Igun goldfields.

The MSMD declared that illegal miners (that is, those engaged in mining who operated without the appropriate licenses, permissions, or permits) were to be reclassified as "informal and artisanal miners." Artisanal miners or small-scale domestic companies mined gold, lead-zinc, niobium (columbium), tantalum, tin, and tungsten ores, as well as barite, clays, feldspar, gemstones, gypsum, phosphate rock, and sand. The Government proposed to establish 10 mineral buying centers to help artisanal miners market industrial minerals (Binniyat, 2006).

The Government's encouragement of the construction of coal-fired electricity-generating plants strengthened investor interest in the planned divestment of the resources of Nigerian Coal Corp. (NCC). The policy to increase the number of coal-fueled plants was partially in response to the vandalism of natural gas pipelines, which adversely affected the availability of natural gas to fuel electricity-generating plants. The Government's planned sale of the nine remaining coalfields of the NCC was rescheduled for early 2007 (Daily Champion, 2006).

The Minister of State for Petroleum Resources, which was part of the Office of the President, was responsible for the management of petroleum resources. The state-owned Nigerian National Petroleum Corp. (NNPC) was the major partner in natural gas and petroleum production joint ventures with subsidiaries of large international oil companies, such as Eni S.p.A. of Italy, Chevron Corp. of the United States, Exxon Mobil Corp. of the United States, Royal Dutch Shell plc of the United Kingdom (formerly the group formed by Royal Dutch Petroleum Co. of the Netherlands and The "Shell" Transport and Trading Company, p.l.c. of the United Kingdom), and Total S.A. of France. Crude oil also was produced under production-sharing contracts, service contracts, and by sole risk operators (primarily independent domestic companies). Most Nigerian natural gas output was produced in association with crude oil.

Commodity Review

Industrial Minerals

Fertilizer, Nitrogen, and Phosphate Rock.—Notore Chemical Industries Ltd. proposed to refurbish and reopen the nitrogenous fertilizer plant at Onne that was formerly operated by the National Fertilizer Co. of Nigeria. Production of urea was scheduled to reach 600,000 metric tons per year (t/yr) after startup in 2007 and 1.3 Mt/yr by 2010. Also in 2006, the Heikio Consortium Ltd. acquired Federal Superphosphate Fertilizer Co. from the Bureau of Public Enterprises, which was the Government's privatization agency (Africa Fertilizer Summit, 2006).

Mineral Fuels

Bitumen.—Exploration pemits for bitumen were offered on two blocks in 2006. CGC Overseas Construction Co. Ltd. of China acquired Block 2. The Government rejected the bids for Block 1, for which the consortium of Gateway Bitumen of Nigeria, Lake Asphalt of Trinidad and Tobago, and Masefield Group of Switzerland was the high bidder.

Natural Gas.—NLNG began production from the 4.1-Mt/yr-capacity LNG train 5 in February. Initial production from the 4.1-Mt/yr-capacity LNG train 4 had started in November 2005. The construction of the 4.1-Mt/yr-capacity LNG train 6 was underway; initial production was scheduled for 2007. Planning for NLNG's proposed 8.4-Mt/yr-capacity LNG train 7 continued (Infrastructure Journal, 2006; LNG World Shipping, 2007).

Preconstruction activity continued on the two-train, 10-Mt/yr-capacity Brass LNG Ltd. facility adjacent to the Nigerian Agip Oil Co. terminal at Brass Island. Initial production was scheduled for 2011. In 2006, Chevron withdrew from the Brass project, and Total acquired Chevron's 17% interest (Platts, 2006a; Eni S.p.A., 2007, p. 28).

Partners in the Olokola LNG (OK LNG) project proceeded with plans to build a four-train, 22-Mt/yr-capacity LNG facility about 120 kilometers (km) east of Lagos. An investment decision was scheduled to be reached in early 2007. Construction of the OK LNG facility was expected to take 5 years to complete (BG Group plc, 2007, p. 30).

A positive feasibility study was completed for the more-than-4,000-km trans-Saharan natural gas pipeline from Brass, Nigeria, to Beni Saf, Algeria. Completion of the 20- to 30-million-cubic-meter-per-year-capacity pipeline was scheduled for 2015. The startup of the West African Gas

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Pipeline, which would transport Nigerian natural gas from Nigeria to Benin, Ghana, and Togo, was delayed until 2007 (Middle East Economic Digest, 2006).

Petroleum.—In 2006, Esso Exploration and Production Nigeria Ltd. (56.25% interest) and Shell Nigeria Exploration and Production Co. Ltd. (43.75%), which operated Oil Prospecting Lease 206 under a production-sharing contract with the NNPC, initiated production of crude oil from the Erha Field, which was located in 1.2 km of water. Shell Petroleum Development Co. of Nigeria Ltd. (SPDC), which comprised NNPC (55%), Royal Dutch Shell (30%), ELF Petroleum Nigeria Ltd. (10%), and Nigerian Agip Oil Corp. (5%), appealed a 2000 National Assembly decision to award $1.5 billion to the group known as the Ijaw Aborigines of Bayelsa State for environmental damages allegedly caused by SPDC operations.

Outlook

National-scale mineral reconnaissance work is expected to continue with funding from the European Union, the U.S. Trade and Development Agency, and the World Bank. Most mineral occurrences in Nigeria need additional evaluation to begin to generate international investor interest. The Government plans to increase its efforts to attract local and foreign investors to explore for and develop economic Nigerian mineral deposits and proposed to declare 2007 as the Year of Mining and Minerals in Nigeria. The ongoing civil unrest in southern Nigeria, which muted international investor interest in the Nigerian solid minerals sector, is expected to continue.

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TABLE 1
NIGERIA: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2002	2003	2004	2005	2006
METALS						
Gold	kilograms	40	50	30	30	40
Iron ore, gross weight	thousand metric tons	25	--	--	60 r	150
Lead:						
Lead-zinc ore		250	250	200	-- r	100
Metal, refined		5,000	5,000	5,000	5,000	5,000
Niobium (columbium) and tantalum concentrates:						
Gross weight		156 4	383 4	100	99	110
Niobium (columbium) content		65	160	40	35	40
Steel		--	--	40,000 r	100,000 r	900,000
Tin:						
Mine output, cassiterite concentrate:						
Gross weight		1,004	2,341	1,300	1,700 r	1,818 4
Sn content		790	1,800	1,000	1,300 r	1,400
Metal, smelter		25	25	25	25	--
INDUSTRIAL MINERALS						
Barite[5]		5,000	5,000	6,000	6,000	6,300
Cement, hydraulic	thousand metric tons	2,100	2,300	2,300	2,400	3,000
Clays:						
Kaolin		32,000 r	52,000 r	58,000 r	93,000 r	100,000
Unspecified		140,000 r	150,000 r	150,000 r	150,000 r	160,000
Feldspar		1,800	500 r	1,000 r	1,100 r	1,200
Gypsum		140,000 r, 4	150,000 r	160,000 r	150,000 r	160,000
Shale	thousand metric tons	1,100 r	1,200 r	1,200 r	1,200 r	1,300
Stone:						
Granite	do.	2,500	2,500	2,000	2,000	--
Limestone	do.	11,415 4	7,408 4	2,100	1,200 r	15,300 4
Marble	do.	1,551 4	840 4	150	149	200
Topaz	kilograms	10	10	10	-- r	10
MINERAL FUELS AND RELATED MATERIALS						
Coal, bituminous		43,482 4	23,089 4	-- r	-- r	10,000
Natural gas:						
Gross	million cubic meters	50,000	53,000	57,747 4	57,369 r, 4	57,754
Dry	do.	30,000	31,000	34,411 4	34,744 4	39,000
Petroleum:						
Crude	thousand 42-gallon barrels	773,000	825,000	900,400 4	923,500 4	813,950 4
Refinery products:						
Liquefied petroleum gases	do.	1,300 r, 4	200 r	20 r, 4	700 r	NA
Gasoline	do.	22,400	6,000 r	4,600 r, 4	14,800	8,500
Kerosene	do.	11,800	5,700 r	4,900 r, 4	10,100	6,100
Distillate fuel oil	do.	18,800	10,300 r	8,800 r, 4	15,800	9,400
Residual fuel oil	do.	19,500 r, 4	15,000 r	12,400 r, 4	19,200	14,400
Unspecified	do.	500 r	3,900 r	3,400 r, 4	4,300 r	1,000
Total	do.	74,300 r	41,100 r	34,100 r	65,000 r	39,400

NA Not available. rRevised. -- Zero.

[1]Estimated data are rounded to no more than three significant digits; may not add to totals shown

[2]Table includes data available through October 15, 2007.

[3]In addition to the commodities listed, amethyst, aquamarine, bitumen, copper (secondary), diamond, emerald, garnet, ilmenite, lime, monazite phosphate rock, ruby, rolled-steel products, rutile, sand and gravel, sapphire, soda ash, talc, tourmaline, tungsten, zinc, and zircon are produced, but available information is inadequate to estimate output.

[4]Reported figure.

[5]Considerably more barite is produced but is considered to be commercially unusable.

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TABLE 2
NIGERIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity
Aluminum		Aluminum Smelter Co. of Nigeria, Ltd.	Smelter at Ikot Abasi	193,000 [1]
Cement		Obajana Cement Plc (Dangote Group)	Lines 1 and 2 at Obajana	5,000,000 [2]
Do.		United Cement Co. of Nigeria (Egyptian Cement Co., 70%, and Flour Mills of Nigeria Ltd., 30%)	Calbar	2,500,000 [3]
Do.		West Africa Portland Cement Co. Plc (Lafarge S.A., 59.95%)	Ewekoro	1,320,000
Do.		Ashakacem Plc (Lafarge S.A., 50.11%)	Ashaka	900,000
Do.		Benue Cement Co. Plc (Dangote Group)	Benue State	900,000 [4]
Do.		West Africa Portland Cement Co. Plc (Lafarge S.A., 59.95%)	Shagamu	600,000
Do.		Cement Co. of Northern Nigeria Plc (Scancem International INS, 50.7%)	Sokoto	500,000
Do.		Edo Cement Co. Ltd. (Scancem International INS, 87%)	Okpella	450,000
Copper, secondary		Sun & Sand Industries Ltd.	Ota	NA
Fertilizer:				
Single superphosphate		Heikio Consortium Ltd.	Kaduna	100,000 [1]
Urea		Notore Chemical Industries Ltd.	Onne	600,000 [1]
Iron and steel:				
Iron ore		National Iron Mining Co. Ltd. (Government, 100%)	Itakpe	5,500
Steel:				
Steel, crude		Ajaokuta Steel Co. Ltd. (Government, 100%)	Blast furnace at Ajaokuta	1,350,000 [1]
Do.		Delta Steel Co. Ltd. (Global Steel Holdings Ltd.)	Electric arc furnaces at Aladja	1,000,000
Do.		African Steel Mills Ltd. (Liberty Group)	Electric arc furnace at Ikorodu	170,000
Rolling mills		Delta Steel Co. Ltd. (Global Steel Holdings Ltd.)	Aladja	300,000
Do.		Jos Steel Rolling Co. Ltd. (Zuma Steel West Africa Ltd.)	Jos rolling mill	210,000 [1]
Do.		Katsina Steel Rolling Co. Ltd. (Dana Steel Ltd.)	Katsina rolling mill	207,000 [1]
Do.		Oshogbo Steel Rolling Co. Ltd. (Kura Holdings Ltd.)	Oshogbo rolling mill	210,000 [1]
Do.		Ajaokuta Steel Co. Ltd. (Government, 100%)	Ajaokuta	130,000
Do.		African Steel Mills Ltd. (Liberty Group)	Rolling mill at Ikorodu	100,000
Do.		Sunflag Steel (Nigeria) Ltd.	Rolling mill at Lagos	30,000
Natural gas, liquefied	million metric tons	Nigeria Liquefied Natural Gas Ltd. (Nigerian National Petroleum Corp., 49%; Shell Gas B.V., 25.6%; Total LNG Nigeria Ltd., 15%; ENI International (N.A.) S.a.r.l., 10.4%)	Trains 1-5 at Finima, Bonny Island	17
Do.	do.	do.	Train 6 at Finima, Bonny Island	4 [3]
Do.	do.	Brass LNG Ltd. (Nigerian National Petroleum Corp., 49%; Brass Holdings Co. Ltd., 17%; ENI International (N.A.) S.a.r.l., 17%; Phillips (Brass) Ltd., 17%)	Trains 1 and 2 on Brass Island	10 [3]
Niobium (columbium) and tantalum		Artisanal miners	Jos region	NA
Petroleum:				
Crude	million 42-gallon barrels	Produced under various joint ventures with Nigerian National Petroleum Corp., production-sharing contracts, service contracts, and sole risk operations	Niger Delta and offshore	980
Refined petroleum products	do.	Port Harcourt Refining Co. Ltd. (Government, 100%)	New Port Harcourt refinery	55
Do.	do.	do.	Old Port Harcourt refinery	22
Do.	do.	Warri Refinery and Petrochemicals Co. Ltd. (Government, 100%)	Warri refinery	43
Do.	do.	Kaduna Refinery and Petrochemicals Co. Ltd. (Government, 100%)	Kaduna refinery	38
Tin		Artisanal miners	Mines at Dutse Nkura	30
Do.		do.	Mines at Gurum, near Jos	30

NA Not available.
[1]Under rehabilitation.
[2]Lines 3 and 4 with an additional annual capacity of 5 million metric tons are under construction
[3]Under construction.
[4]Expansion to 2.7 million metric tons per year is underway.

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The Mineral Industry of Rwanda

By Thomas R. Yager

In 2006, Rwanda's share of the world's tantalum mine production amounted to nearly 4%. The country also reexported ores of niobium (columbium) and tantalum, tin (cassiterite), and tungsten (wolframite) produced in Congo (Kinshasa). Rwanda was not a globally significant consumer of minerals. In 2005 (the latest year for which data were available), the mining and quarrying sector accounted for less than 1% of the gross domestic product (Banque Nationale du Rwanda, 2006, p. 16-17; Magyar, 2007).

Production

In 2005, the production of tungsten increased by 255%; niobium (columbium) and tantalum, by 25%; and natural gas, by 21%. Cement production declined by 3% in 2005 compared with that of 2004; output increased by 43% from 2000 to 2005 (Banque Nationale du Rwanda, 2006, p. 26). Mineral production was estimated to have remained nearly unchanged in 2006 (table 1).

Structure of the Mineral Industry

The state-owned Régie d'Exploitation et de Développement des Mines (REDEMI) produced cassiterite, columbite-tantalite, and wolframite; privately owned companies and artisanal miners also produced these mineral commodities. Cimenterie du Rwanda (Cimerwa), which was the country's only cement producer, was a joint venture between the Government and Chinese investors. In July 2006, the Government reportedly took full control of Cimerwa; the company was subsequently privatized in December (Office of the Prime Minister, 2006b; Mutesi, 2007).

Commodity Review

Metals

Niobium (Columbium) and Tantalum.—REDEMI operated columbite-tantalite processing facilities at Gatumba. In January 2006, the Cabinet authorized the drafting of a joint-venture agreement between REDEMI and Tantalite Ore Trading Company in the Rutongo Quarry Area (Office of the Prime Minister, 2006a).

Tin.—Metal Processing Association (MPA) and REDEMI operated cassiterite-processing facilites at Gisenyi and Rutongo, respectively. MPA also operated a tin smelter in Gisenyi, which was shut down in April 2006 because of the lack of a continuous power supply. Rwanda's exports of cassiterite were 3,835 metric tons (t) at a value of about $15.6 million in 2006. Cassiterite accounted for 11% of total exports in 2006 compared with 14% in 2004 and 1% in 2001 (Banque Nationale du Rwanda, 2007; Kivu Resources Ltd., 2007).

Tungsten.—REDEMI operated a wolframite-processing facility at Nyakabingo. Exports of wolframite (tungsten ore) amounted to 1,436 t at a value of about $9.39 million in 2006, or nearly 7% of total exports. From 2001 to 2004, wolframite accounted for less than 1% of national exports (Banque Nationale du Rwanda, 2007).

Mineral Fuels

Natural Gas.—Rwanda produced small amounts of natural gas at Cape Rubona on the shore of Lake Kivu. The Government had a joint-venture agreement with Dane Associates Ltd. to build a new 35-megawatt power station that would use natural gas extracted from Lake Kivu. Dane expected to start producing natural gas in mid-2007; the project was estimated to cost $78 million (Kakimba and Kigali, 2006).

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TABLE 1
RWANDA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004	2005	2006[e]
Cement		100,568	110,104 r	104,288 r	101,127 r	100,000
Columbite-tantalite, ore and concentrate:						
Gross weight	kilograms	277,000 r	187,000 r	220,000 r	276,000 r	280,000
Nb content	do.	87,000 r	59,000 r	69,000 r	86,000 r	88,000
Ta content	do.	61,000 r	41,000 r	49,000 r	61,000 r	62,000
Gold, mine output, Au content	do.	10 e	2	-- e	-- e	--
Natural gas, gross	thousand cubic meters	900 r	300 r	140 r	170 r	170
Tin:						
Mine output, Sn content		197	192	550 r, e	700 e	700
Refined[e]		40	200	200	200	--
Tungsten, mine output, W content		234 r	86 r	113 r	401 r	400

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised. -- Zero.
[1]Table includes data available through August 16, 2007.
[2]In addition to the commodities listed, sapphire and pozzolanic materials are also known to be produced, but information is inadequate to make reliable estimates of output.

TABLE 2
RWANDA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity[1]
Cement	Cimenterie du Rwanda (Cimerwa)	Plant at Cyangugu	115,000.
Niobium (columbium) and tantalum	Régie d'Exploitation et de Développement des Mines (REDEMI)	Concentrator at Gatumba	20 Nb_2O_5 and Ta_2O_5 in concentrate.[e]
Sapphire	do.	Mines at Cyangugu	NA.
Tin	do.	Concentrator at Rutongo	370 in concentrate.[e]
Do.	Metal Processing Association	Concentrator at Gisenyi	NA.
Do.	do.	Smelter at Gisenyi	200.
Tungsten	Régie d'Exploitation et de Développement des Mines (REDEMI)	Concentrator at Nyakabingo	170 in concentrate.[e]

[e]Estimated. NA Not available.
[1]Abbreviations used in this table for commodities include the following: Nb_2O_5--niobium (columbium) oxide, and Ta_2O_5--tantalum oxide.

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The Mineral Industry of Somalia

By Thomas R. Yager

Somalia is an East African country located on the Gulf of Aden and the Indian Ocean that produced small quantities of gemstones and salt. The country also had deposits of feldspar, gypsum, iron ore, kaolin, limestone, natural gas, quartz, silica sand, tantalum, tin, and uranium. The mineral industry made a small contribution to Somalia's exports and economy in general.

Civil war continued in Somalia in 2006. In June, the Union of Islamic Courts (UIC) took control of Mogadishu and most of southern Somalia from regional warlords. In late December, the Transitional Federal Government (TFG) and Ethiopian military forces drove the UIC from most of the territory that it controlled (United Nations Integrated Regional Information Networks, 2006).

The collapse of the central Government in 1991 led to ambiguity over mineral rights. The governing authority of Somaliland (a region in northern Somalia) granted East African Mining Corp. Ltd. exclusive rights to explore all mineral deposits in Somaliland. The company planned to start producing gemstones and marble in the Berbera area in mid-2006. Somaliland's declaration of independence in 1991 has not been internationally recognized.

In June 2006, Range Resources Ltd. of Australia announced that its agreement with the governing authority of Puntland (which is located to the east of Somaliland) that gave the company a majority interest in the rights to all mineral and mineral fuel exploration in Puntland was supported by the TFG. The agreement was previously declared to be invalid on the grounds that only the national Government had the authority to negotiate mineral rights. Range planned to farm out or form joint-venture agreements for some properties (Range Resources Ltd., 2006).

Production

Mineral production and trade data continued to be unavailable because of the lack of a functioning central Government since 1991 and the conflict that pervaded most of the country. The war forced the closure of Somalia's cement plant and oil refinery. The Indian Ocean tsunami of December 26, 2004, disrupted salt production in Hurdiye in late 2004 and early 2005; it is unclear to what extent output has recovered (United Nations World Food Programme, 2005).

Structure of the Mineral Industry

Gemstone and salt producers appear to be artisanal and small-scale in nature. The cement plant and refinery were operated by parastatal companies prior to their closure.

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THE MINERAL INDUSTRY OF SOUTH AFRICA

By Thomas R. Yager

The Republic of South Africa remained one of the world's leading mining and mineral-processing countries. In 2006, South Africa's share of world platinum production amounted to 77%; kyanite, 56%; chromite, 40%; vanadium, 40%; palladium, 39%; vermiculite, 38%; manganese, 20%; gold, 11%; fluorspar, 4%; antimony, 4%; aluminum, 3%; nickel, 3%; phosphate rock, 2%; and iron ore, 2%. The country's share of world reserves of platinum-group metals (PGM) amounted to 85%; zirconium, 37%; vanadium, 23%; fluorspar, 17%; rutile, 16%; gold, 14%; ilmenite, 10%; phosphate rock, 8%; manganese, 7%; and nickel, 6% (Carlin, 2007; Corathers, 2007; George, 2007a, b; Jasinski, 2007; Jorgenson, 2007; Kuck, 2007; Magyar, 2007; Miller, 2007; Papp, 2007; Plunkert, 2007; Potter, 2007a, b).

Minerals in the National Economy

The mining industry accounted for 7.9% of the gross domestic product in 2006; crude and processed mineral products accounted for nearly 40% of total exports. About 71% of crude mineral products and 72% of processed mineral products by value were exported in 2006. Employment in the South African mining industry amounted to 458,600 in 2006 compared with 444,132 in 2005. PGM mining accounted for 36.7% of the mining industry's employment; gold, 34.9%; coal, 12.6%; diamond, 4.4%; and other minerals, 11.4% (Mwape and others, 2007, p. 10, 12, 14, 16, 20).

Government Policies and Programs

The Mineral and Petroleum Resources Development Act of 2002 vested mineral ownership rights in the Government. Companies that owned mineral rights under previous legislation were required to convert their mineral rights to the new system within 5 years of the enactment of the new mining law. The Diamonds Act of 2005 was enacted in early 2006; this legislation was intended to promote domestic cutting and polishing of rough diamond (Mwape and others, 2007, p. 3-4).

The Government's Black Economic Empowerment program required that black ownership of the mining industry reach 15% by 2009 and 26% by 2014. Recent deals to increase black ownership included the acquisition of Wakefield Investments (Pty) Ltd. by Shanduka Group and the purchase of a 15% interest in the Marula PGM mine by Tubatse Platinum (Pty) Ltd. In 2006, 26% of Natal Portland Cement Company (Pty) Ltd. [a subsidiary of Cimentos de Portugal, SGPS, SA (Cimpor)] was purchased by the company's employee trust and black empowerment investment consortium Siyaka Cement Investment Holdings (Pty) Ltd. (Building Bulletin, 2007a; Mwape and others, 2007, p. 2).

Production

In 2006, titaniferous slag production increased by about 21%; lead mine, 15%; manganese metal, alloys, and compounds, 14%; manganese ore, 13%; silicon metal and alloys, 12%; ferrochromium, 8%; zinc mine, 7%; zirconium mine, 6%; iron ore and vanadium, 5% each; and PGM, 2%. The output of crude petroleum declined by 39%; uranium, 20%; sulfur, 17%; natural gas, 13%; gold, 8%; vermiculite, 6%; diamond, 4%; and nickel, 2%. Chromite and coal output remained nearly unchanged (Martin Kohler, Deputy Director of Statistics, Department of Minerals and Energy of the Republic of South Africa, written commun., August 13, 2007).

Structure of the Mineral Industry

Most of the South African mineral industry was privately owned. The production of gold and diamond, which were produced mostly by artisanal miners in many African countries, was dominated by large-scale producers in South Africa. The leading producer's share of total output varied sharply by commodity; the leading producer of diamond accounted for 96% of national production; iron ore, 75%; manganese ore, 49%; chromite, 42%; gold, 29%; and coal, 24%.

Mineral Trade

In 2006, exports of PGM amounted to $7.9 billion; gold, $5.41 billion; coal, $3.18 billion; nickel, $534 million; manganese ore, $224 million; copper, $157 million; chromite, $73 million; silver, $35 million; vermiculite, $26 million; and other crude mineral products, which included diamond, ilmenite, rutile, and zircon, $1.72 billion. Exports of ferrochromium amounted to $1.53 billion; manganese metal and alloys, $494 million; vanadium alloys and other vanadium products, $391 million; silicon metal and alloys, $119 million; and other processed mineral products, which included aluminum, $2.16 billion (Martin Kohler, Deputy Director of Statistics, Department of Minerals and Energy of the Republic of South Africa, written commun., August 13, 2007).

South Africa's imports of industrial minerals and processed industrial mineral products amounted to $1.88 billion; ferrous metals and products, $210 million; diamond, $135 million; precious metals, $130 million; other gemstones, $92 million; coking coal, $66 million; and nonferrous metals, $29 million. In 2005, imports of crude petroleum amounted to $6.07 billion (Mwape and others, 2007, p. 21).

Commodity Review

Metals

Aluminum.—South Africa produced primary refined aluminum from imported alumina. BHP Billiton plc of the United Kingdom operated the Bayside and Hillside primary aluminum smelters at Richards Bay. In 2006, production at Hillside increased to 704,000 metric tons (t) from 690,000 t

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in 2005. Production at Bayside increased to 191,000 t from 161,000 t (BHP Billiton Group, 2006, 2007).

Chromium.—Xstrata plc of Switzerland and its joint-venture partners operated the Helena, the Horizon, the Kroondal, and the Thorncliffe Mines, which had a total capacity of 4.68 million metric tons per year (Mt/yr) of chromite. The company's production declined to 3.13 million metric tons (Mt) from 3.6 Mt in 2005. At the Kroondal Mines, production decreased to 1.63 Mt in 2006 from 1.86 Mt in 2005; output at the Thorncliffe Mine remained nearly unchanged at 1.2 Mt. The Helena Mine, which opened in 2006, produced 228,000 t. The Boshoek and the Waterval Mines shut down in 2006 (Xstrata plc, 2007, p. 101).

Xstrata and its joint-venture partner Merafe Resources Ltd. operated the Boshoek, the Lydenburg, the Rustenburg, and the Wonderkop ferrochromium plants. These plants had a total combined capacity of 1.62 Mt/yr. Production decreased at Rustenburg to 316,000 t in 2006 from 383,000 t in 2005, and at Wonderkop, to 249,000 t from 333,000 t. At Lydenburg and Boshoek, production remained nearly unchanged at 379,000 t and 193,000 t, respectively. In the third quarter of 2006, Xstrata and Merafe started production at the Lion plant; output amounted to 44,000 t. The plant was expected to reach its full capacity of 360,000 metric tons per year (t/yr) in the second quarter of 2007 (Xstrata plc, 2007, p. 57-58, 101).

Samancor Chrome Ltd. (a subsidiary of Kermas Group Ltd.) produced an average of about 3 Mt/yr from the Eastern Chrome Mines in Mpumalanga Province and the Western Chrome Mines in North West Province. Production amounted to 3.2 Mt in 2005. About 2.3 Mt/yr of the company's output was consumed in its ferrochromium plants and 700,000 t/yr was sold in domestic and export markets. Samancor planned to increase chromite production to 10 Mt/yr by 2015 (Brown, 2006; Tran, 2007).

Samancor operated the Ferrometals plant in Witbank, the Middleburg Ferrochrome plant in Middleburg, and the Tubatse Ferrochrome plant in Steelpoort. The company's ferrochrome production amounted to about 1 Mt/yr. Samancor planned to increase output to 1.2 Mt/yr by the end of 2006, 1.5 Mt/yr by 2011, and 2.5 Mt/yr by 2015. Initial increases in production were likely to result from expansions of the Middleburg and the Steelpoort plants; Samancor also planned to build new ferrochromium plants. The cost of the new mines and smelters was estimated to be $1.3 billion; expanding existing operations, $100 million; and a new chrome chemicals plant, $100 million (Brown, 2006; Metal Bulletin, 2006b).

Assmang Ltd. (African Rainbow Minerals Ltd. (ARM), 50%, and Assore Ltd., 50%) operated the Dwarsrivier Mine in Mpumalanga. In fiscal year[1] 2005-06, production declined to 526,000 t from 568,000 t in fiscal year 2004-05. The Dwarsrivier Mine had a capacity of 1.2 Mt/yr of run-of-mine ore; Assmang planned to increase capacity to 1.5 Mt/yr of run-of-mine ore (1.1 Mt/yr of salable ore) by 2009. Resources amounted to 71.8 Mt at a grade of 39.6% chromium oxide (Cr_2O_3), of which 30.2 Mt was reserves at a grade of 39.6% Cr_2O_3 (African Rainbow Minerals Ltd., 2006, p. 30, 37, 39).

Assmang produced ferrochromium at the Machadodorp plant in Mpumalanga Province with a capacity of 290,000 t/yr. In fiscal year 2005-06, output decreased to 230,000 t from 266,000 t in fiscal year 2004-05 (African Rainbow Minerals Ltd., 2006, p. 36, 39).

ARM and its joint-venture partner LionOre Mining International Ltd. of Canada planned to open the Nkomati chrome mine by mid-2007. Production at the mine was expected to be 720,000 t/yr of chromite; the life of the mine was estimated to be 5 years (African Rainbow Minerals Ltd., 2006, p. 18).

In October 2006, ASA Metals (Pty) Ltd. was producing chromite at the rate of 420,000 t/yr from its Dilokong Mine at Burgersfort in Mpumalanga Province. ASA planned to increase output to about 650,000 t/yr by the end of 2006. The company was also producing ferrochromium at the rate of 120,000 t/yr in 2006; production in previous years was about 100,000 t/yr. ASA planned to add a new smelter that would increase ferrochromium production to 380,000 t/yr by 2008. The company planned a further expansion to 500,000 t/yr of ferrochromium in 2010 or 2011; increased ore supplies were to be obtained by deepening the Dilokong Mine (Markram, 2006).

Hernic Ferrochrome (Pty) Ltd. (a subsidiary of Mitsubishi Corp. of Japan) operated a ferrochromium plant with a capacity of 420,000 t/yr. The company mined chromite at the Maroelabult open pit mine from 1996 to 2000; shaft sinking at a new underground mine at Bokfontein was planned in mid-2008. The new mine was expected to have a capacity of 1.5 Mt/yr (Hernic Ferrochrome (Pty) Ltd., undated).

In late 2006, International Ferro Metals Ltd. (IFM) announced that its new chromite mine and ferrochromium plant in North West Province would start production in January 2007. The plant had a capacity of 267,400 t/yr; IFM had signed contracts with customers to purchase about 170,000 t/yr of the plant's output. Resources at the mine were estimated to be 45.9 Mt at a grade of 35.6% Cr_2O_3, of which 13.02 Mt at a grade of 30.3% Cr_2O_3 was reserves. The project was expected to cost about $170 million (Ferro-Alloys Monthly, 2006; Mining Magazine, 2006).

Tata Steel Ltd. of India planned to complete a new ferrochromium plant at Richards Bay in the fourth quarter of 2007. The plant was expected to have an initial capacity of 120,000 t/yr; Tata planned phased expansions to increase the capacity to 240,000 t/yr. The company planned to export most of the plant's output to stainless steel producers in Western Europe, the Republic of Korea, India, and Taiwan (Hindu, The, 2006).

Copper.—Rio Tinto plc operated the Palabora copper mine, smelter, and refinery. In 2006, mine production at Palabora increased to 66,202 t of copper from 65,892 t in 2005. The production of smelted copper decreased to 78,980 t in 2006 from 84,926 t in 2005, and the production of refined copper increased to 81,163 t from 80,319 t (Palabora Mining Company Ltd., 2007, p. 78-79).

Anglo American Platinum Corp. Ltd. (Anglo Platinum) produced 11,100 t of refined copper at Rustenburg Base Metal Refiners in 2006 compared with 11,300 t in 2005. About 10,100 t was attributable to the company's PGM mining operations compared with 10,500 t in 2005; the remainder was attributable to purchased concentrates (Anglo American Platinum Corp. Ltd., 2007, p. 86).

ARM produced 3,398 t of copper at the Nkomati nickel mine in fiscal year 2005-06. The company planned to increase

[1]Fiscal years run from the end of June in one year through the end of June in the following year unless otherwise specified.

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production to 12,000 t/yr of copper by fiscal year 2009-10 (African Rainbow Minerals Ltd., 2006, p. 18).

Gold.—The long-term decline in the country's gold output continued in 2006, with national gold mine production decreasing to 272,128 kilograms (kg) from 294,671 kg in 2005 (table 1). The decline was broadly based, with output decreasing from each of South Africa's five ranked gold producers (AngloGold Ashanti Ltd. and Gold Fields Ltd., 2008, p. 21).

AngloGold Ashanti Ltd. operated the Great Noligwa, the Kopanang, the Moab Khotsong, and the Tau Lekoa Mines in the West Wits area near Carletonville; and the Mponeng, the Savuka, and the Tau Tona Mines in the Vaal River area near Klerksdorp. AngloGold Ashanti's gold production declined to 79,430 kg in 2006 from 83,220 kg in 2005 (AngloGold Ashanti Ltd. and Gold Fields Ltd., 2008, p. 21).

At the Mponeng Mine, production increased to 18,500 kg in 2006 from 15,900 kg in 2005 because of higher volumes and ore grades. At the Tau Tona Mine, lower volumes and seismicity concerns led to a decrease in production to 14,700 kg from 15,600 kg. Output declined to 2,800 kg from 3,900 kg at Savuka; the planned closure of the mine was postponed from 2006 to 2010 because of higher gold prices. In 2007, production at the Mponeng Mine was expected to be about 17,100 kg, and at Tau Tona, about 14,600 kg. In early 2007, AngloGold Ashanti planned to make a decision on a project that would deepen the Mponeng Mine and postpone its closure from 2018 to 2024. Output at Savuka was expected to be about 2,200 kg in 2007 (Mining Review Africa, 2006b; AngloGold Ashanti Ltd., 2007, p. 48-51).

In 2006, production at the Great Noligwa Mine declined to 19,100 kg from 21,600 kg in 2005 because of lower ore grades; production also decreased at Tau Lekoa and Kopanang. In 2007, production at Great Noligwa was expected to be about 18,000 kg. At Kopanang, output was expected to increase to about 14,600 kg in 2007 from 13,900 kg in 2006; and at Tau Lekoa, to decline to 5,000 kg from 5,500 kg. The Moab Khotsong Mine produced about 2,500 kg of gold in 2006; AngloGold Ashanti planned to increase output to 15,400 kg by 2012. The life of the mine was expected to be 15 years (AngloGold Ashanti Ltd., 2007, p. 51-54).

Harmony Gold Mining Company Ltd. of South Africa mined gold at numerous mines that included the Elandsrand, the Evander, the Kalgold, the Orkney/Welkom, and the Randfontein. The company's production of gold was 65,580 kg in 2006 compared with 72,430 kg in 2005. Harmony planned to increase its gold production to more than 93,000 kilograms per year (kg/yr) by 2010; new projects included the Tshepong Decline in February 2008; the Phakisa Shaft in February 2009; the Doorknop South Reef in June 2010; and the deepening of the Elandsrand Mine in December 2010 (African Rainbow Minerals Ltd., 2006, p. 53; Harmony Gold Mining Company Ltd., 2006; AngloGold Ashanti Ltd. and Gold Fields Ltd., 2008, p. 21).

Gold Fields Ltd. of South Africa produced gold at the Beatrix, the Driefontein, and the Kloof Mines; the company's output declined to 80,617 kg in 2006 from a revised 85,298 kg in 2005. Production at the Driefontein Mine declined to 33,419 kg in 2006 from a revised 36,432 kg in 2005; at the Kloof Mine, to 28,501 kg from a revised 29,887 kg, and at the Beatrix Mine, to 18,697 kg from a revised 18,979 kg (Gold Fields Ltd., 2007).

Gold Fields planned to spend $455 million on a deepening of the Driefontein Mine that would extend its life by at least 13 years to about 2035. The company expected to start shaft sinking in October 2007; full production from the project was expected by 2019. The project could result in the production of an additional 270,000 kg of gold. Gold Fields also planned to invest $193 million on a deepening of the Kloof Mine that would increase gold production by an additional 62,000 kg between 2011 and 2021 (Mining Review Africa, 2006a).

Placer Dome Inc. of Canada produced gold at the South Deep Mine. In 2006, output was 9,420 kg compared with 14,342 kg in 2005. In January, Placer Dome's board of directors approved a bid by Barrick Gold Corp. of Canada to purchase the company. In September, Gold Fields announced plans to purchase Barrick's share in South Deep. Gold Fields planned to increase production at South Deep to nearly 25,000 kg/yr (Metal Bulletin, 2006a; AngloGold Ashanti Ltd. and Gold Fields Ltd., 2008, p. 21).

In 2006, gold production by Durban Roodepoort Deep Ltd. (DRD) of South Africa declined to 11,058 kg from a revised 13,590 kg in 2005. Output at the Blyvooruitzicht Mine amounted to 4,844 kg in 2006; the Crown Mine, 3,241 kg; and the East Rand Proprietary Mine (ERPM), 2,943 kg. DRD was engaged in an exploration program at ERPM that could extend the mine's life to 2020 from 2009 (Durban Roodepoort Deep Ltd., 2007a, b).

Thistle Mining Inc. of South Africa operated the President Steyn Mine in Free State. The company produced 4,544 kg of gold compared with 5,430 kg in 2005; production was disrupted for 5 months by an accident. Thistle planned to produce about 4,400 kg of gold in 2007 (Thistle Mining Inc., 2007, p. 3, 27-28).

Anglo Platinum's production of refined gold from Rustenburg Base Metal Refiners declined to 3,534 kg in 2006 from 3,655 kg in 2005. Of this amount, 3,182 kg was attributable to Anglo Platinum's PGM mining operations in 2006 compared with 3,359 kg in 2005; the remainder was attributable to purchased concentrates (Anglo American Platinum Corp. Ltd., 2007, p. 86).

In May 2006, Aflease started construction on the Modder East underground mine, which is located 30 kilometers (km) east of Johannesburg. The capital costs for developing the mine were estimated to be about $108 million. Production was expected to start in October 2008; Aflease planned to produce an average of 3,400 kg/yr of gold between 2010 and 2015. The life of the mine was likely to be 10 years (Uranium One Inc., 2006).

First Uranium Corp. of Canada (a subsidiary of Simmer and Jack Mines Ltd.) planned to produce an average of 10,000 kg/yr of gold at the Ezulwini Mine between 2009 and 2024; the mine was expected to open in October 2007. The company also planned to produce an average of 4,500 kg/yr of gold at the Buffelsfontein Mine (formerly known as the North West Mine) between 2010 and 2021; production was expected to start in 2008. Simmer and Jack acquired Buffelsfontein from DRD in 2005 (First Uranium Corp., 2007).

South Africa's production of refined gold declined to 427,313 kg in 2006 from 451,533 kg in 2005 and 445,300 kg in 2004. The decline was attributable to the shutdown of the refinery operated by Musuku Beneficiation Systems (Pty) Ltd., which

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was a subsidiary of Harmony. Musuku produced 29,170 kg of gold in 2006 compared with 62,820 kg in 2005 (AngloGold Ashanti Ltd. and Gold Fields Ltd., 2008, p. 7, 29).

Rand Refinery Ltd. in Germiston (AngloGold Ashanti, 53%; Gold Fields, 33%; DRD, 10%; Avgold Ltd., 2%; and Western Areas Ltd., 2%) produced 394,053 kg of refined gold in 2006 compared with 384,811 kg in 2005. About 61% of the refinery's gold was sourced from South African mines, and 37%, from mines in other countries. Ghana accounted for 51% of Rand's imports; Mali, 18%; Zimbabwe, 9%; Tanzania, 8%; Guinea, 6%; and other countries, 8%. The remainder of South Africa's refined gold was produced by seven small gold recycling companies (AngloGold Ashanti Ltd. and Gold Fields Ltd., 2008, p. 27-28).

Iron and Steel.—Mittal Steel South Africa Ltd. accounted for most of South Africa's production of crude steel at its Newcastle, Saldanha, Vanderbijlpark, and Vereeniging plants. The production of crude steel at Vanderbijlpark decreased to 3.67 Mt in 2006 from 3.82 Mt in 2005 because of mechanical problems and shortages of iron ore. At Saldanha, production declined to 1.2 Mt in 2006 from 1.25 Mt in 2005 because of problems with power supply. Output remained nearly unchanged at Newcastle and Vereeniging (Mittal Steel South Africa Ltd., 2007, p. 29, 34).

Mittal planned to increase crude steel production at Vanderbijlpark by about 1.9 Mt/yr by the end of 2009 and 2.3 Mt/yr by 2012. By February 2007, the company planned to increase production at Vanderbijlpark by 445,000 t/yr by relining blast furnace D, and gain an additional 660,000 t/yr from increased efficiency. The installation of new direct-reduced iron kilns was expected to increase output by 325,000 t/yr by the second half of 2007 and by 830,000 t/yr by the second half of 2009. By 2012, Mittal planned to increase production by 355,000 t/yr by relining blast furnace C. The estimated cost of the expansion at Vanderbijlpark was about $700 million from 2006 to 2009. The company also planned to increase capacity at Saldanha and Vereeniging by a combined 105,000 t/yr (Mittal Steel South Africa Ltd., 2005, p. 5, 7; 2007, p. 19).

Highveld operated a steel mill at Witbank. In 2006, the company's production of crude steel was 777,017 t compared with 787,589 t in 2005 and 849,554 t in 2001. Scaw Metals [a subsidiary of Anglo American plc (Anglo American)] also produced crude steel at its Germiston plant (Highveld Steel and Vanadium Corp. Ltd., 2007, p. 3).

Iron Ore.—Assmang, Highveld Steel and Vanadium Corp. Ltd. of South Africa, and Kumba Iron Ore Ltd. of South Africa mined iron ore. In 2006, Kumba Resources Ltd. was reorganized; the iron ore assets were put under Kumba Iron Ore, and the coal, industrial minerals, mineral sands, and zinc assets became Exxaro Resources Ltd. Kumba operated the Sishen Mine in Northern Cape Province and the Thabazimbi Mine in Limpopo Province. In 2006, output from the Sishen Mine increased to 28.7 Mt from nearly 28.5 Mt in 2005. Production at Thabazimbi declined to 2.42 Mt from to 2.53 Mt (Kumba Iron Ore Ltd., 2007, p. 27-28).

In 2006, exports accounted for 79% of Kumba's iron ore sales, and domestic consumers, 21%. China accounted for 35% of Kumba's iron ore exports; Europe, 35%; and Japan, 23%. Kumba's share of the world's seaborne iron ore trade amounted to 3% (Kumba Iron Ore Ltd., 2007, p. 19).

Kumba planned to complete an expansion of the Sishen Mine by the beginning of 2009. The expansion was likely to increase salable iron ore production by 13 Mt/yr; the increase would be at least partially attributable to improved beneficiation technology. The cost of the expansion was expected to be about $1.15 billion. Kumba was conducting a prefeasibility study on the expansion of the Sishen Mine by an additional 10 to 20 Mt/yr; the company planned to complete the study in 2007. Resources at Sishen were estimated to be 2.45 billion metric tons at a grade of 58.7% iron (Kumba Iron Ore Ltd., 2007, p. 31-32, 35).

Kumba was carrying out a feasibility study on the Sishen South project, which is located 90 km south of the Sishen Mine. Depending upon favorable results of the study, Sishen South was expected to produce 9 Mt/yr of iron ore. The company planned to complete the feasibility study in the second quarter of 2007. Resources at Sishen South were estimated to be 373 Mt at a grade of 64.7% iron (Kumba Iron Ore Ltd., 2007, p. 31, 35).

Kumba was also conducting a feasibility study on the Phoenix project at the Thabazimbi Mine, which would maintain production at 2.4 Mt/yr and extend the life of the mine to 30 years from 4 years. The company planned to complete the feasibility study in the second quarter of 2007 (Kumba Iron Ore Ltd., 2007, p. 31-32, 35).

Assmang produced iron ore at the Beeshoek Mine in Northern Cape, which had a rated capacity of 6 Mt/yr. In fiscal year 2005-06, production declined to 5.54 Mt from 6.43 Mt in fiscal year 2004-05 (African Rainbow Minerals Ltd., 2006, p. 30, 32, 65).

Assmang was considering the development of the iron ore resources at the Bruce, King, and Mokaning properties (BKM). If development of BKM proceeded, a new mine was expected to be completed in fiscal year 2007-08 at a cost of $446 million. Exports from the Beeshoek Mine were expected to decline to less than 1 Mt/yr by fiscal year 2008-09. Assmang's total iron ore exports were likely to be about 9 Mt in fiscal years 2007-08 and 2008-09. The company was also considering an expansion of BKM's capacity to 16.8 Mt/yr from 8.4 Mt/yr in fiscal year 2009-10 at a cost of $223 million (African Rainbow Minerals Ltd., 2006, p. 30-31, 33-34, 67).

Highveld mined titaniferous magnetite at its Mapochs open pit mine near Roossenekal in the Mpumalanga Province. In 2006, the company produced 2.1 Mt of ore compared with 2.07 Mt in 2005 and 2.36 Mt in 2001 (Highveld Steel and Vanadium Corp. Ltd., 2007, p. 3).

Lead and Zinc.—Anglo American operated the Black Mountain lead-zinc-copper mine near Aggeneys in Northern Cape Province. In 2006, production amounted to 34,100 t of zinc and 48,300 t of lead from 1.4 Mt of ore milled compared with 32,100 t of zinc and 42,200 t of lead from 1.35 Mt of ore milled in 2005 (Anglo American plc, 2007, p. 153).

Zinc Corp. of South Africa Ltd. (a subsidiary of Exxaro Resources Ltd.) operated South Africa's only zinc refinery at Springs. In 2006, production declined to 90,000 t from 102,000 t in 2005 because of lower-quality concentrates from the refinery's main suppliers (Exxaro Resources Ltd., 2007, p. 5, 31).

Manganese.—Samancor Manganese (Pty) Ltd. (BHP Billiton, 60%, and Anglo American, 40%) operated the Mamatwan open pit mine and the Wessels underground mine

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near Hotazel in Northern Cape Province. In 2006, Samancor's production of manganese ore increased to 2.51 Mt from 2.33 Mt in 2005. The company's ferromanganese and silicomanganese plant at Meyerton was South Africa's leading producer of manganese alloys. In 2006, output of manganese alloys was 469,000 t compared with 419,000 t in 2005 (BHP Billiton Group, 2006, 2007).

Manganese Metal Company (Samancor Manganese, 51%) operated the Krugersdorp and the Nelspruit plants, which produced manganese metal. The Krugersdorp plant shut down in 2006 (Ryan's Notes, 2006b).

Assmang produced manganese ore at the Gloria and the Nchwaning Mines. Capacity at Nchwaning was 3 Mt/yr, and at Gloria, 600,000 t/yr. In fiscal year 2005-06, production at the mines increased to 2.57 Mt from 1.81 Mt in fiscal year 2004-05. Reserves at Nchwaning were estimated to be 117 Mt at a grade of 44.9% manganese and at Gloria, 75.3 Mt at a grade of 38.2% manganese (African Rainbow Minerals Ltd., 2006, p. 30, 35-36, 61-62).

Assmang operated the Cato Ridge ferromanganese plant in Kwa-Zulu Natal, which had a capacity of 300,000 t/yr. In fiscal year 2005-06, output increased to 260,000 t from 197,000 t in fiscal year 2004-05. Assmang was considering an increase in Cato Ridge's capacity to 380,000 t/yr (African Rainbow Minerals Ltd., 2006, p. 35-36)

Highveld produced ferromanganese and silicomanganese at its plant at Witbank. In 2006, Highveld's manganese alloy output increased to 136,573 t from 126,439 t in 2005 (Highveld Steel and Vanadium Corp. Ltd., 2007, p. 3).

Renova Group of Russia was engaged in a joint-venture agreement with domestic companies Chancellor House and Pitsoe ya Setshaba to develop the Kalahari manganese ore deposit. By the second quarter of 2007, Renova planned to complete a feasibility study on mining at Kalahari. Depending on favorable results of the study, the company planned to build a mine to produce between 1.5 and 2 Mt/yr of manganese ore. The mine was expected to be completed in 5 years. Renova also planned to build a ferromanganese plant at the Coega Industrial Development Zone in Eastern Cape Province. The plant, which had a planned capacity of 300,000 t/yr, was expected to be completed in 3 years (Metal Bulletin, 2006c; Ryan's Notes, 2006a).

Nickel.—Most of South Africa's nickel mine production was a coproduct of PGM mining. Anglo Platinum produced 21,300 t of refined nickel at Rustenburg Base Metal Refiners in 2006 compared with 20,500 t in 2005. About 19,200 t was attributable to the company's PGM mining operations compared with 19,000 t in 2005 (Anglo American Platinum Corp. Ltd., 2007, p. 86).

In fiscal year 2005-06, Implats produced 7,700 t of refined nickel from its refinery northeast of Johannesburg compared with 8,100 t in fiscal year 2004-05. Production at this plant was from purchased concentrates and toll refining. Implats also produced nickel from its Impala PGM mines near Rustenburg in North West Province; production of refined nickel from Impala remained unchanged at 7,900 t (Impala Platinum Holdings Ltd., 2006, p. 39, 63).

ARM produced 5,616 t of nickel at the Nkomati Mine in fiscal year 2005-06. The company planned to increase production to 21,500 t/yr of nickel by fiscal year 2009-10. Reserves at Nkomati were estimated to be 66.3 Mt at a grade of 0.48% nickel. The life of the mine was expected to be 20 years (African Rainbow Minerals Ltd., 2006, p. 18, 71).

Platinum-Group Metals.—In 2006, Anglo Platinum produced 162,900 kg of refined PGM compared with 144,700 kg in 2005. About 144,400 kg was attributable to the company's mining operations in 2006 compared with 131,600 kg in 2005. Platinum produced from Anglo's mining operations amounted to 78,000 kg; palladium, 42,200 kg; and rhodium, 8,900 kg (Anglo American Platinum Corp. Ltd., 2007, p. 86).

In 2006, output by Anglo Platinum at Rustenburg increased to about 51,100 kg of PGM from 46,600 kg in 2005; at Amandelbult, to 35,452 kg from 30,883 kg; and at Bafukeng Rasimone Platinum Mine (BRPM), to 11,863 kg from 9,546 kg. Production at the Kroondal Mine (a joint venture with Aquarius Platinum Ltd. of South Africa) increased to 13,866 kg of PGM from 13,009 kg in 2005; platinum production increased to 8,307 kg from 7,782 kg. At PPRust, PGM production declined to 13,067 kg from 13,791 kg. The Mototolo Mine (a joint venture with Xstrata) started production in 2006; PGM output amounted to 426 kg (Anglo American Platinum Corp., 2007, p. 89-90, 92, 94, 99; Aquarius Platinum Ltd., 2006, p. 5; 2007, p. 6).

Anglo Platinum planned to increase PGM production at Mototolo to about 3,400 kg in 2007; output was likely to be 4,000 kg/yr when the project reached full production. The company also planned to increase production at PPRust by 132% starting in early 2008. At Rustenburg, production was expected to increase by between 8% and 14% starting in 2008. Anglo Platinum planned to increase output at Amandelbult by 5% in 2007 and by 23% starting in 2012 (Anglo American Platinum Corp. Ltd., 2007, p. 36, 38, 45, 54, 92).

Implats operated the Impala Mines near Rustenburg in North West Province and the Marula Mine in Limpopo Province. In fiscal year 2005-06, production of refined PGM at Impala was 62,297 kg compared with 64,132 kg in fiscal year 2004-05; platinum production increased to 35,001 kg from 34,668 kg. Higher output was attributable to an increase in the amount of ore milled. Implats planned to maintain production at about 34,000 kg/yr of platinum for the 30-year life of the mines. In fiscal year 2005-06, the company increased the capacity of the Precious Metals Refinery to more than 62,000 kg/yr of refined platinum and decided to expand the capacity to 71,500 kg/yr by 2008. Implats commenced studies on further increases in the refinery's capacity initially to 78,000 kg/yr and subsequently to 87,000 kg/yr (Impala Platinum Holdings Ltd., 2006, p. 39, 46-47).

In fiscal year 2005-06, platinum production at Marula increased to 1,244 kg from 927 kg in fiscal year 2004-05 because of an increase in ore milled. Implats planned to increase platinum production at Marula to 1,900 kg in fiscal year 2006-07, 2,900 kg in fiscal year 2007-08, and 4,200 kg in fiscal year 2008-09 (Impala Platinum Holdings Ltd., 2006, p. 52).

Implats also operated a refinery located northeast of Johannesburg; production at this plant was from purchased concentrates and toll refining. In fiscal year 2005-06, the refinery's production remained nearly unchanged at 46,245 kg of PGM. Implats planned to increase production in fiscal year 2006-07 (Impala Platinum Holdings Ltd., 2006, p. 63-64).

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African Rainbow Minerals and Implats were engaged in a joint venture to develop the Two Rivers Mine in Mpumalanga Province. The mine was expected to reach its full capacity of 3,700 kg/yr of platinum, 2,100 kg/yr of palladium, and 600 kg/yr of rhodium in fiscal year 2007-08. Capital costs of the project were likely to be about $181 million. African Rainbow Minerals also planned to produce 4,000 kg/yr of PGM with the expansion of the Nkomati nickel mine; output amounted to 1,538 kg in fiscal year 2005-06 (African Rainbow Minerals Ltd., 2006, p. 18, 23).

Lonmin plc of the United Kingdom mined PGM at the Eastern Platinum Mine, the Karee Mine, and the Western Platinum Mine, which are located east of Rustenburg in North West Province, and at the Limpopo Mine. From September 2005 to September 2006, these mines produced 30,068 kg of platinum compared with 28,938 kg in the previous 12 months. Total production of PGM increased to 57,889 kg from 54,957 kg. The Limpopo Mine produced 3,526 kg of PGM that included 1,568 kg of platinum (Lonmin plc, 2006, p. 28).

Lonmin planned to increase platinum production at the Eastern Platinum, the Karee, and the Western Platinum Mines to 31,000 kg in 2010 and to 36,500 kg in 2012. The Limpopo Mine was expected to produce 2,700 kg in 2009; the Limpopo Phase 2 project could increase output to 5,600 kg in 2012. The Pandora project could start in 2011 and produce 1,700 kg in 2012. In 2006, the Limpopo Phase 2 and Pandora projects were in the prefeasibility stage. Lonmin also planned to increase its platinum smelting capacity to about 43,500 kg/yr in 2010; a subsequent expansion to 62,000 kg/yr was in the prefeasibility stage (Lonmin plc, 2006, p. 6-7).

Aquarius operated the Marikana Mines. In 2006, production of PGM at Marikana was 3,351 kg compared with 3,159 kg in 2005; platinum production rose to 2,017 kg from 1,999 kg. Output at Marikana was expected to increase to a rate of 2,800 kg/yr of platinum and 1,300 kg/yr of palladium by the end of 2006. The Everest Mine produced 5,373 kg of PGM in 2006. The company planned to increase production at Everest to 7,000 kg/yr of PGM (Anglo American Platinum Corp. Ltd., 2007, p. 17; Aquarius Platinum Ltd., 2006, p. 2, 7, 9; 2007, p. 2, 9).

Silicon.—In 2006, South Africa's production of silicon metal and ferrosilicon increased to more than 200,000 t from 180,494 t in 2005. Silicon Smelters (Pty) Ltd. was the only domestic producer of silicon metal. In 2006, Highveld produced 51,057 t of ferrosilicon compared with 42,656 t in 2005 from its plant at Witbank. Silicon Technology (Pty) Ltd. also produced ferrosilicon (Highveld Steel and Vanadium Corp. Ltd., 2007, p. 3).

Titanium and Zirconium.—In 2006, Exxaro produced 319,000 t of ilmenite from the Hillendale Mine in KwaZulu Natal Province compared with 356,000 t in 2005. Rutile production increased to 25,000 t from 23,000 t, and zircon, to 50,000 t from 47,000 t. In 2006, Exxaro approved construction of the Fairbreeze Mine; production was expected to start in 2008 if the necessary mining and environmental permits were acquired. The life of the Fairbreeze Mine was estimated to be more than 25 years (Exxaro Resources Ltd., 2007, p. 5, 30).

Anglo American mined ilmenite, rutile, and zircon at its Namakwa Sands project on South Africa's western coast. Ilmenite production at Namakwa Sands declined to 272,200 t in 2006 from 316,100 t in 2005, and rutile, to 28,200 t from 29,100 t. Zircon output remained nearly unchanged at 128,400 t. By 2008, Anglo American planned to complete a $43 million expansion to increase zircon and rutile output to about 150,000 t and 37,000 t, respectively (Mining Magazine, 2006).

Vanadium.—Highveld produced vanadium from titaniferous magnetite ore at the Mapochs Mine. In 2006, the company produced 64,964 t of vanadium slag compared with 66,750 t in 2005; the average vanadium pentoxide (V_2O_5) content of the slag amounted to about 22% between 2001 and 2005. Highveld produced 7,572 t of vanadium in ferrovanadium in 2006 compared with 8,565 t in 2005; the company also produced V_2O_5 and various vanadium chemicals for sale. Highveld announced plans to increase its production of vanadium by 15% over the next few years (Highveld Steel and Vanadium Corp. Ltd., 2007, p. 3, 19).

Xstrata produced V_2O_5 at Rhovan in Brits; output increased to 9,819 t of V_2O_5 from 9,146 t in 2005. Higher production was attributable to the use of vanadium-rich spinel. Ferrovanadium production at Rhovan increased to 4,907 t in 2006 from 4,592 t in 2005. The plant had a capacity of 10,600 t/yr of V_2O_5; Xstrata planned to increase capacity by about 3,900 t/yr. The development of the project depended upon approval by Xstrata's Board of Directors and Government regulatory agencies (Xstrata plc, 2007, p. 58-59, 101).

Vametco operated a mine in Brits with a capacity of 5,400 t/yr of V_2O_5 (table 2). In August 2006, Evraz Group S.A. purchased a 73% share in Strategic Minerals Corp. of the United States, which was Vametco's parent company (Strategic Minerals Corp., 2006).

Pinnacle Resources Inc. of the United States planned to produce 6,000 t/yr of V_2O_5 from about 770,000 t/yr of magnetite ore at its property northwest of Mokopane in Limpopo Province. Resources were estimated to be 419 Mt that contained 6.4 Mt of V_2O_5. The cost of the project was estimated to be $106 million; Pinnacle was seeking joint-venture partners in 2006 (Pinnacle Resources Inc., 2006).

Industrial Minerals

Cement.—Domestic cement consumption increased to 12.7 Mt in 2006 from 11.4 Mt in 2005 because of infrastructure development and residential construction. Cement demand was expected to increase to 17 Mt by 2010. Cement producers invested about $650 million in capacity expansions in 2006 to alleviate shortages (Baloyi, 2007; Building Bulletin, 2007b; Cimentos de Portugal, SGPS, SA, 2007, p. 69-70).

Pretoria Portland Cement Co. (Pty) Ltd. (PPC) was South Africa's leading cement producer. By April 2008, PPC planned to increase its capacity to 8 Mt/yr by expanding its Dwaalboom plant. Lafarge South Africa Ltd. expected to increase its capacity at Lichtenburg to 3.7 Mt/yr from 2.7 Mt/yr in 2008. Cimpor operated the Simumu plant, which produced at its full capacity of nearly 1.06 Mt/yr in 2006. By the fourth quarter of 2007, Cimpor planned to increase capacity at Simumu to 1.7 Mt/yr. Holcim South Africa Ltd. also planned to upgrade its Dudfield plant (Baloyi, 2007; Cimentos de Portugal, SGPS, SA, 2007, p. 69-70).

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Diamond.—De Beers Group accounted for most of South Africa's rough diamond production. In 2006, the company's output declined to nearly 14.57 million carats from 15.16 million carats in 2005. At Venetia, production declined to 8.12 million carats from 8.52 million carats, and at Cullinan, to 1.15 million carats from 1.3 million carats. The Koffiefontein Mine was sold to Petra Diamonds Ltd. in November 2006. The Finsch Mine produced 2.22 million carats; the Kimberley Mine, 1.94 million carats; the Namaqualand Mine, 978,415 carats; and The Oaks Mine, 102,805 carats (De Beers Group, 2007, p. 10).

In October 2006, De Beers was awarded a mining license for the Voorspoed Mine in Free State Province. The company planned to complete the new mine at a cost of $170 million by 2009; production was expected to be 1 million carats per year. In mid-2007, De Beers also planned to commence an upgrade at the Finsch Mine that could increase output by 500,000 carats per year. De Beers expected to start offshore diamond mining at the Atlantic coast at the rate of 280,000 carats per year in mid-2007 (De Beers Group, 2007, p. 10, 13).

Petra Diamonds Ltd. produced diamond from the Helam Mine in North West Province, the Sedibeng Mine in Northern Cape Province, and the Star Mine in Free State Province. The company produced 175,000 carats in fiscal year 2005-06 compared with 144,000 carats in fiscal year 2004-05. Petra planned to produce 500,000 carats from the Helam, the Koffiefontein, the Sedibeng, and the Star Mines in fiscal year 2009-10 (Petra Diamonds Ltd., 2007, p. 7-8, 10).

Fluorspar.—Van den Heever Fluorspar Works, Vergenoeg Mining Corp. (Pty) Ltd., and Witkop Fluorspar Mine (Pty) Ltd. (a subsidiary of Sallies Ltd.) produced fluorspar. Sallies purchased the Buffalo Mine, which shut down in 2000, from Transvaal Mining and Finance Company Ltd. In November 2006, Sallies was producing at a rate of about 145,000 t/yr at Witkop; the company planned to produce 48,000 t/yr at Buffalo (Creamer, 2006; Industrial Minerals, 2006).

Vermiculite.—In 2006, production at the Palabora Mine declined to 197,765 t from 209,801 t in 2005. Reserves at Palabora amounted to 38.9 Mt at a grade of 34% vermiculite. About 84% of South Africa's vermiculite output was exported in 2006 (Palabora Mining Company Ltd., 2007, p. 79; Martin Kohler, Deputy Director of Statistics, Department of Minerals and Energy of the Republic of South Africa, written commun., August 13, 2007).

Mineral Fuels and Related Materials

Coal.—Anglo American increased its production of coal to 59.3 Mt in 2006 from 56.9 Mt in 2005. Production at Isibonelo increased to 4.02 Mt from 1.36 Mt; at Goedehoop, to 8.5 Mt from 6.3 Mt; and at New Denmark, to 5.51 Mt from 4.14 Mt. Higher output from these mines more than offset lower output at the Bank and the New Vaal Mines. Production at the Bank Mine declined to 477,600 t from 3.2 Mt, and at New Vaal, to 16.3 Mt from 17.1 Mt. Anglo American supplied about 35 Mt/yr of thermal coal to South African utility Eskom; the output of the Isibonelo Mine was sold to Sasol Ltd. of South Africa for use in its coal-to-liquids plants (Anglo American plc, 2007, p. 18, 150).

The Mafube Mine produced 719,400 t of coal in 2006. Anglo American and Exxaro had a joint-venture agreement to increase capacity at Mafube to 5 Mt/yr by 2008. The capital cost of the project was estimated to be $264 million. Coal from Mafube would be sold to Eskom and export markets. Other projects under consideration by Anglo American included the Zondagsfontein implementation, which could produce 6.6 Mt/yr starting in 2009; MACWest, 2.7 Mt/yr starting in 2009; Elders Opencast, 6.5 Mt/yr starting in 2011; and Elders Underground, 4 Mt/yr starting in 2013. These projects remained unapproved by the Board of Directors at the end of 2006 (Anglo American plc, 2007, p. 29, 150).

Ingwe Coal Corp. Ltd. (a subsidiary of BHP Billiton Group) produced coal at the Douglas, the Khutala, the Klipspruit, the Koornfontein, the Middleburg, and the Rietspruit Mines in Mpumalanga Province. In 2006, Ingwe produced 50.6 Mt of coal compared with 53.8 Mt in 2005. The company had a joint-venture agreement with Xstrata for the operation of the Douglas and the Middleburg Mines, where production declined to 21.4 Mt in 2006 from 23 Mt in 2005. Sales to local utilities amounted to 29.7 Mt in 2006; exports, 20.3 Mt; and sales to other South African customers, 938,000 t (BHP Billiton Group, 2006, 2007; Xstrata plc, 2007, p. 103).

In fiscal year 2005-06, Sasol Ltd. of South Africa decreased its coal production to 46.2 Mt from 47.7 Mt in fiscal year 2004-05. At the Secunda Mining Complex, which included the Bosjesspruit, the Brandspruit, the Middelbult, the Syferfontein, and the Twistdraai Mines, output declined to 44.6 Mt from 45.1 Mt. Lower production from Twistdraai more than offset higher production from other mines. The decline in output was attributable to the Sasolburg petrochemical plant switching from coal to natural gas as raw material. Sasol consumed 42 Mt of coal in the production of synthetic fuels and other chemicals and exported 3.6 Mt of coal in fiscal year 2005-06 (Sasol Ltd., 2006, p. 39-40, 43).

Exxaro operated the Grootegeluk and the Tshikondeni Mines in Limpopo Province and the Leeuwpan Mine in Mpumalanga Province. In November 2006, Exxaro acquired the Arnot, the Matla, and the New Clydesdale Mines and the North Block Complex from Eyesizwe Coal (Pty) Ltd. Production from the company's mines amounted to about 37.1 Mt in 2006. Sales to Eskom amounted to 34.7 Mt (Exxaro Resources Ltd., 2007, p. 4).

In August 2006, a new beneficiation plant with a capacity of 730,000 t/yr was started at Grootegeluk; the plant was expected to reach full capacity in mid-2007. Construction started in late 2006 on the Inyanda Mine near Witbank, which was expected to reach full production of 1 Mt/yr of thermal coal starting in 2008 (Exxaro Resources Ltd., 2007, p. 4, 28; undated).

In June 2006, Exxaro also completed a feasibility study on expanding capacity at the Grootegeluk Mine by an additional 7.3 Mt/yr. At yearend, Eskom and Exxaro were negotiating commercial agreements. Depending upon the success of the negotiations, development of the project could commence in 2008 with production starting in 2010 (Exxaro Resources Ltd., 2007, p. 30; undated).

Xstrata operated 11 coal mines at Breyten, Ermelo, and Witbank. In 2006, production at the company's mines increased to 18.9 Mt from 16.6 Mt in 2005. Production at the Boschmans

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Mine increased to 2.84 Mt from 2.15 Mt; at the Waterpan Mine, to 2.19 Mt from 504,000 t; and at South Witbank, to 2.13 Mt from 1.86 Mt. The Goedgevonden Mine produced 1.05 Mt in 2006 compared with 956,000 t in 2005 (Xstrata plc, 2007, p. 102-103).

ARM and Xstrata were engaged in a joint venture to increase output at the Goedgevonden Mine to 6.7 Mt/yr. About 3.6 Mt/yr of coal was expected to be consumed domestically and about 3.1 Mt/yr to be exported. The increases in coal exports were subject to rail and mine capacity constraints; exports were not likely to reach the planned level until after 2009. The life of the mine was expected to be 32 years. Capital costs were estimated to be $392 million (African Rainbow Minerals Ltd., 2006, p. 43; Xstrata plc, 2007, p. 67).

Uranium.—AngloGold Ashanti mined uranium as a coproduct of gold at the Great Noligwa and the Tau Lekoa Mines. In 2006, the company's production of uranium oxide (U_3O_8) declined to 639 t from 795 t in 2005. AngloGold Ashanti planned to increase its uranium production by about 40% starting in late 2008 by treating ore from the Kopanang gold mine and upgrading its new uranium processing plant (Mining Review Africa, 2006b).

Uranium One Inc. of Canada planned to start production at the Dominion underground uranium mine in the first quarter of 2007. The company planned to produce an average of 1,700 t/yr of U_3O_8 between 2011 and 2014; production was expected to be nearly 2,000 t of U_3O_8 in 2012. Total production in the first phase of the project was expected to be 12,300 t of U_3O_8 and 15,600 kg of gold; capital costs were estimated to be $244 million. Reserves were estimated to be 18.5 Mt that contained 14,200 t of U_3O_8 (Uranium One Inc., 2006).

First Uranium planned to produce an average of 450 t/yr of U_3O_8 at the Buffelsfontein tailings project between 2010 and 2021; production was expected to start in 2008. The company also planned to produce an average of 450 t/yr of U_3O_8 at the Ezulwini Mine between 2009 and 2024; uranium production was expected to start in June 2008 (First Uranium Corp., 2007).

Outlook

Capacity expansions by numerous producers are likely to lead to higher production of coal, ferrochromium, ferromanganese, fluorspar, ilmenite, iron ore, manganese ore, nickel, PGM, rutile, steel, uranium, vanadium, and zircon for the next 5 years. These expansions depend upon the continuation of the broad-based increase in world demand for minerals. Factors that could inhibit these plans included the strength of the South African rand and the high rates of HIV infection in the mining workforce.

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TABLE 1
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2002	2003	2004	2005	2006[p]
METALS						
Aluminum metal, primary		706,916	735,000 r	866,074 r	846,213 r	895,000
Antimony concentrate:						
Gross weight		9,910	9,000	8,400 e	10,000 r, e	10,000 e
Sb content (58% Sb)		5,746	5,291	4,967	5,979 r	6,000 e
Chromiun, gross weight:						
44% to 48% chromic oxide	thousand metric tons	2,459	2,640	2,888	2,394	1,755
Less than 44% chromic oxide	do.	3,977	4,766	4,789	5,100	5,663
Total	do.	6,436	7,406	7,677	7,494	7,418
Cobalt:						
Mine output, Co content e		520	400	460	400	400
Refinery output:		366	271	309	268	267
Copper:						
Mine (company output), Cu content		129,589	120,800	102,574	96,600 r	100,000 e
Metal:						
Smelter		119,667	112,025	89,300	110,000 e	110,000 e
Refined, primary		130,000 r	121,000	91,495 r	99,388 r	104,137
Gold, primary	kilograms	398,523	373,300	337,223	294,671	272,128
Iron and steel:						
Ore and concentrate:						
Gross weight	thousand metric tons	36,484	38,085 r	39,322	39,542	41,326
Fe content (62%-65%)	do.	23,200	24,200	24,800	24,900	26,000
Metal:						
Pig iron	do.	5,823	6,234	6,011	6,130	6,160
Direct-reduced iron	do.	1,702	1,542	1,633	1,781	1,754
Ferroalloys, electric arc furnace:						
Chromium ferroalloys	do.	2,351	2,813	2,965 r	2,812	3,030
Ferromanganese	do.	619	607	612	571 r	670 e
Ferrosilicon	do.	142	135	141	127 r	140 e
Ferrovanadium e	do.	19 r	19 r	20 r	19 r	18
Silicomanganese e	do.	273	301	310	270	320
Silicon metal	do.	43	49	51	54	60 e
Other	do.	85	80	80 e	80 e	80
Total e	do.	3,530 r	4,000 r	4,180 r	3,930 r	4,320
Steel:						
Crude	do.	9,095 r	9,481	9,500	9,493	9,721
Stainless	do.	550	643	718	658	747
Lead:						
Concentrate, Pb content		49,444	39,941	37,485	42,159	48,273
Refined, secondary		60,900	64,900	64,100	65,300 r	70,000 e
Manganese:						
Ore and concentrate, gross weight:						
Metallurgical:						
More than 48% manganese	thousand metric tons	1,600	1,619	1,988	2,467	1,452
45% to 48% manganese	do.	728	178	372	454	1,812
40% to 45% manganese	do.	19	783	1,041	935	895
30% to 40% manganese	do.	955	905	864	743	1,042
Total	do.	3,302	3,485	4,265	4,599	5,201
Chemical, 35% to 65% manganese dioxide	do.	20	16	17	12	12
Grand total	do.	3,322	3,501	4,282 r	4,611	5,213
Metal, electrolytic e	do.	40	40	40	44 2	44
Nickel:						
Mine output, concentrate, nickel content		38,546	40,842	39,851	42,392	41,599
Metal, electrolytic		31,646	40,800	39,900	42,400 e	41,600 e

See footnotes at end of table.

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TABLE 1--Continued
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2002	2003	2004	2005	2006[p]
METALS--Continued						
Platinum-group metals:						
Iridium	kilograms	3,682	6,444	5,769	6,280	6,172
Platinum	do.	132,897	148,348	153,239	163,711	168,125
Palladium	do.	63,758	70,946	76,403	82,961	86,265
Rhodium	do.	15,175	16,816	16,294	20,224	19,633
Ruthenium	do.	21,022	23,537	24,696	29,805	27,333
Other[3]	do.	107	59	--	--	--
Total	do.	236,641	266,150	276,401	302,981	307,528
Silver	do.	113,142	79,817	71,600 r	87,874	86,951
Titanium:[e]						
Ilmenite concentrate	thousand metric tons	1,800	2,000	1,900	1,900	1,900
Rutile concentrate	do.	138 r	108 r	110 r	115 r	123
Total	do.	1,940 r	2,110 r	2,010 r	2,020 r	2,020
Titaniferous slag[4]	do.	973 r	1,010 r	1,020 r	1,020 r	1,230
Uranium oxide		998	894	887	795	639
Vanadium, vanadium metal content		25,227	27,172	23,302	22,604	23,780
Zinc:						
Concentrate:						
Gross weight		118,900	103,100	80,000 e	80,000 e	85,000 e
Zn content		64,580	41,400	32,001	32,112	34,444
Metal, smelter, primary		111,000	111,000 r	104,000	102,000	90,000
Zirconium concentrate (baddeleyite and zircon)[e]		429,000 r	404,000 r	368,000 r	376,000 r	398,000
INDUSTRIAL MINERALS						
Andalusite		165,087	164,921	234,625	228,375 r	230,000 e
Asbestos, chrysotile		--	6,218	--	--	--
Cementitious products:						
Cement, finished product, sales	thousand metric tons	8,525	8,883	12,348	13,000 e	13,000 e
Granulated slag, fly ash, and others, sales	do.	1,099	1,280	1,436	1,500 e	1,500 e
Total	do.	9,624	10,163	13,784	14,500 e	14,500 e
Clays:						
Attapulgite		13,288	14,585	20,419	34,340	49,225
Bentonite		101,100	145,060	55,859	139,833	32,878
Fire clay		101,150	90,604	133,258	171,773	157,087
Flint clay, raw and calcined		41,963	53,279	53,367	36,607	34,413
Kaolin		86,700	86,365	81,901	59,356	51,602
Brick clay, local sales	thousand metric tons	6,203	7,593	9,523 r	11,237 r	11,131
Diamond, natural:						
Gem	thousand carats	4,350	5,144	5,800 e	6,400 e	6,100 e
Industrial	do.	6,526	7,540	8,500 e	9,400 e	9,100 e
Total	do.	10,876	12,684	14,295	15,776	15,153
Feldspar		66,600 r	57,738	53,721	57,534	76,722
Fluorspar:						
Acid-grade		216,000 e	221,000	250,000 e	250,000 e	250,000 e
Metallurgical-grade		11,000 e	14,000	15,000 e	16,000 r,e	20,000 e
Total		227,000	235,000	265,000	266,000 r	270,000
Gemstones, semiprecious, Tiger's eye[e]	kilograms	-- [2]	-- [2]	--	--	--
Gypsum, crude		421,861	394,069	524,000 r	547,581	554,020
Industrial or glass sand (silica)	thousand metric tons	2,251 r	2,311 r	2,249 r	2,671	3,234
Lime	do.	1,585	1,571 r	1,738	1,417	1,583
Magnesite, crude		87,200	86,100	65,900	54,800 r	55,000 e
Mica, scrap and ground		880	1,003	285 r	924	828
Nitrogen, N content of ammonia		491,900	493,200	459,100	460,000 e	460,000 e
Perlite[e]		400	400	400	400	400

See footnotes at end of table.

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TABLE I--Continued
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2002	2003	2004	2005	2006[p]
INDUSTRIAL MINERALS--Continued						
Phosphate rock:						
Gross weight	thousand metric tons	2,803	2,643	2,735	2,577	2,629
Phosphorus pentoxide content	do.	1,086	1,030	1,070	1,000 [e]	1,020 [e]
Pigments, mineral, natural:						
Ochers		143	608	360	382	372
Oxides		109	156	152	128	218
Total		252	764	512	510	590
Salt		429,429	441,306	332,673	399,087	464,909
Sodium sulfate, natural		53,793	52,813	56,267	55,184	43,303
Stone, n.e.s.:						
Dimension:						
Granite and norite[5]		705,800	463,200 [r]	548,600 [r]	607,500 [r]	285,790
Slate		24,800 [r]	40,700	47,500	52,312	33,154
Crushed and broken:						
Limestone and dolomite	thousand metric tons	20,738	21,267	22,031 [r]	24,813 [r]	25,000 [e]
Quartzite	do.	318	--	--	--	--
Shale:						
For cement	do.	275	345	357	501	533
Other[5]	do.	67	49	50 [e]	50 [e]	50 [e]
Total	do.	342	394	407 [e]	551 [e]	583 [e]
Aggregate and sand, n.e.s.	do.	28,916	32,587	44,437	49,970	58,519
Sulfur:						
S content of pyrite (53.45%)	do.	183	176	165	133	68
Byproduct:						
Metallurgy	do.	179	174	180	220 [r]	200 [e]
Petroleum	do.	170	264	288	422 [r]	375 [e]
Total	do.	532	614	633	776	643
Talc and related materials:						
Talc		2,511	6,719	8,141	8,469	10,966
Pyrophyllite (wonderstone)		15,587	14,350	28,987	60,267	74,886
Vermiculite		210,000	182,802	196,893	209,801	197,765
MINERAL FUELS AND RELATED MATERIALS						
Coal (salable product):						
Anthracite	thousand metric tons	1,305	1,206	1,247 [r]	1,640 [r]	1,584
Bituminous	do.	218,895	238,105	241,500 [r]	243,300 [r]	243,198
Total	do.	220,200	239,311	242,747 [r]	244,940 [r]	244,782
Natural gas	million cubic meters	2,000 [e]	1,247 [r]	1,916 [r]	2,060 [r]	1,795
Petroleum:[6]						
Crude	thousand 42-gallon barrels	10,950	4,068	6,769	7,277	4,441
Refinery products:						
Liquefied petroleum gases	do.	3,677	3,561	3,538	3,500 [e]	3,500 [e]
Gasoline	do.	73,077	77,452	71,166	71,000 [e]	71,000 [e]
Jet fuel	do.	16,726	17,350	14,331	14,000 [e]	14,000 [e]
Kerosene	do.	4,754	4,831	4,893	4,900 [e]	4,900 [e]
Distillate fuel oil	do.	59,620	63,268	53,272	53,000 [e]	53,000 [e]
Residual fuel oil	do.	34,452	47,959	27,919	28,000 [e]	28,000 [e]
Other, includes lubricants and greases[e]	do.	21,000	21,000	17,000	17,000 [e]	17,000 [e]
Total[e, 7]	do.	213,000	235,000	192,000	191,000	191,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [p]Preliminary. [r]Revised. -- Zero.

[1]Table includes data available through November 30, 2007.

[2]Reported figure.

[3]Difference between total production reported by the South African Department of Minerals and Energy, Mineral Development Branch, Mineral Economics Directorate and palladium, platinum, and rhodium supplies (shipments) reported in Johnson and Matthey Annual Platinum Review. Includes iridium and ruthenium production plus excess palladium, platinum, and rhodium inventory.

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TABLE 1--Continued
SOUTH AFRICA: PRODUCTION OF MINERAL COMMODITIES[1]

[4]Except for about 45,000 metric tons per year, slag derived from titaniferous magnetite by Highveld Steel and Vanadium Corp. Ltd.; titaniferous slag is all from the smelting of ilmenite and likely represents most of that mineral's production, for which data are unavailable.
[5]Converted from reported cubic meters by using 1 cubic meter = 2.7 metric tons.
[6]In addition, Sasol Ltd. produced about 67 million barrels per year of synthetic liquid petroleum fuels from coal.
[7]Excludes refinery fuel and losses.

Source: Mineral Economics Directorate, South Africa Department of Minerals and Energy.

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TABLE 2

SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006[1]

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum	BHP Billiton Aluminium South Africa (Pty) Ltd. (BHP Billiton Plc, 100%)	Hillside smelter at Richards Bay	700.
Do.	do.	Bayside smelter at Richards Bay	180.
Andalusite	Rhino Minerals (Pty) Ltd. (Imerys, 100%)	Rhino Mine near Thabazimbi	120.
Do.	do.	Havercroft Mine at Penge	60.
Do.	Samrec Pty. Ltd. of France (Imerys, 100%)	Annesley Mine at Penge	75.
Do.	do.	Krugerspost Mine, near Lydenburg	50.
Do.	do.	Andalusite Refractories Mine at Groot Marico	15.
Do.	Hoogenoeg Andalusite (Pty) Ltd.	Hoogenoeg Mine and plant	36.
Do.	Andalusite Resources (Pty) Ltd. (African Mineral Trading and Exploration (Pty) Ltd.)	Maroeloesfontein, near Thabazimbi, Northern Province	30.
Antimony	Consolidated Murchison Ltd. (Metorex Pty. Ltd., 100%)	Consolidated Murchison Mine near Gravelotte	7,000 antimony concentrate.
Cement	Pretoria Portland Cement Co. (Pty) Ltd. (Barlworld Trust Co. Ltd., 68%)	De Hoek, Dwaalboom, Hercules, Port Elizabeth, Riebeeck, and Slurry plants	6,800.
Do.	Alpha Ltd. [Holcim Ltd. (Switzerland)]	Dudfield and Ulco plants	3,700.
Do.	Lafarge South Africa Ltd. [Lafarge (France)]	Lichtenburg plant in North West Province	2,700.
Do.	Natal Portland Cement Co. (Pty) Ltd. (Cimentos de Portugal SGPS, S.A., 98%)	Simumu plant	1,055.
Chromite	Xstrata plc, 79.5%; Merafe Resources Ltd., 20.5%	Kroondal Mines at Rustenburg	2,460.
Do.	do.	Thorncliffe Mine at Steelpoort	1,440.
Do.	do.	Helena Mine at Steelpoort	600.
Do.	do.	Waterval Mine at Rustenburg	480.
Do.	do.	Boshoek Mine at Boshoek	360.
Do.	do.	Horizon Mine at Pilansberg	180.
Do.	Samancor Chrome Ltd. (Kermas Group Ltd., 100%)	Eastern Chrome Mines in Steelpoort Valley, Mpumalanga Province	2,000.
Do.	do.	Western Chrome Mines in Northern Province	1,800.
Do.	Assmang Ltd. (African Rainbow Minerals Ltd., 50%, and Assore Ltd., 50%)	Dwarsrivier Mine	880.[e]
Do.	Bayer (Pty) Ltd.	Rustenburg Chrome Mine	450.
Do.	Dilokong Chrome Mine (Pty) Ltd. (ASA Metals (Pty) Ltd., 100%)	Dilokong Mine, near Lydenburg	320.[e]
Do.	Merafe Resources Ltd.	Horizon Mine	250.
Do.	National Manganese Mines (Pty) Ltd.	Buffelsfontein Mine at Mooinooi	180.
Coal	Anglo Coal Ltd. (Anglo American plc, 100%)	Bank, Goedehoop, Isibonelo, Kleinkopje, Kriel, Landau, Mafube, New Denmark, New Vaal and Nooitgedacht Mines	60,000.[e]
Do.	Ingwe Coal Corp. Ltd. (BHP Billiton Plc, 100%)	Witbank Coalfield, Mpumalanga Province:	
Do.	do.	Middelburg Mine (Xstrata plc, 16% interest)	17,000 bituminous.
Do.	do.	Khutala Underground Mine	15,100 bituminous.
Do.	do.	Optimum Open Pit Mine	13,500 bituminous.
Do.	do.	Douglas Mine (Xstrata plc, 16% interest)	8,500 bituminous.
Do.	do.	Koornfontein Mines	5,200 bituminous.
Do.	do.	Klipspruit Mine	3,600 bituminous.
Do.	Zululand Anthracite Colliery (BHP Billiton Plc, 100%)	Zululand Mine, KwaZulu Natal Province	600 anthracite.[e]
Do.	Sasol Ltd.	Secunda Mines:	
Do.	do.	Twistdraai Mine	10,600.
Do.	do.	Syferfontein Mine	8,700.
Do.	do.	Brandspruit Mine	8,400.
Do.	do.	Middlebult Mine	8,200.
Do.	do.	Bosjesspruit Mine	8,100.
Do.	do.	Moholo and Mooikraal Mines	1,700.

See footnotes at end of table.

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TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006[1]

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Coal--Continued		Exxaro Resources Ltd. (Anglo American plc, 67%)	Grootegeluk Mine in Limpopo Province	18,600.
Do.		Exxaro Resources Ltd.	Matla Mine in Mpumalanga Province	14,000.
Do.		do.	Arnot Mine in Mpumalanga Province	5,000.
Do.		do.	North Block Mine in Mpumalanga Province	3,000.
Do.		do.	Leeuwpan Mine in Mpumalanga Province	2,500.
Do.		do.	New Clydesdale Mine in Mpumalanga Province	1,400.
Do.		do.	Tshikondeni Mine in Limpopo Province	414.
Do.		Xstrata plc, 74%	Tweefontein Division (Boschmans, Goedgevonden, South Witbank, Waterpan, and Witcons Mines) at Witbank	8,200.
Do.		do.	ATC and ATCOM Mines at Witbank	4,100.
Do.		do.	Mpumalanga Division (Spitzkop and Tselentis Mines) at Breyton and Ermelo	3,300.
Do.		do.	iMpunzi Division (Phoenix and Tavistock Mines) at Witbank	3,200.
Do.		Anker Holdings B.V.	Elandsfontein Mine	2,040.
Do.		do.	Golfview Mine	1,740.
Do.		Kangra Group Pty. Ltd.	Savmore and Welgedacht collieries	3,000.[e]
Do.		Wakefield Investments (Pty) Ltd. (subsidiary of Shanduka Group)	Bankfontein, Lakeside, Leeuwfontein, and Middleburg Townlands Mines	2,300.[e]
Do.		Total Coal SA (Pty) Ltd.	Dorsfontein and Forzando Mines	2,000.[e]
Do.		Graspan Colliery Pty Ltd.	Graspan Mine	1,800.
Do.		Kuyasa Mining (Pty) Ltd.	Delmas Mine	1,200.[e]
Copper		Palabora Mining Co. Ltd. (Rio Tinto Ltd., 57%, and Anglo American plc, 29%)	Palabora Mines at Phalaborwa	80 copper in concentrate.[2]
Do.		do.	Smelter at Phalaborwa	135 anodes.[2]
Do.		do.	Refinery at Phalaborwa	135 cathodes.
		Anglo American Platinum Corp. Ltd. (Anglo American plc, 74.1%)	Amandebult, Rustenburg, and Union sections; and Bafokeng Rasimone, Lebowa, Modikwa, Potgietersrust, and Western Limb Mines	13 mine.[e]
Do.		do.	Rustenburg Base Metal Refiners	12 refined.[e]
Do.		Black Mountain Mineral Development Co. (Pty) Ltd. (Anglo American plc, 100%)	Black Mountain Mine near Aggeneys	6 copper in concentrate.
Do.		Lonmin Platinum (Lonmin plc., 73%, and Impala Platinum Holdings Ltd., 27%)	Marikana Mines (Eastern Platinum, Karee, and Western Platinum) near Rustenburg and Limpopo Mine	3 mine.[e]
Do.		do.	Base Metals Refinery	3 refined.[e]
Do.		Impala Platinum Ltd. (Impala Platinum Holdings Ltd., 100%)	do.	NA.
Diamond	thousand carats	De Beers Consolidated Mines Ltd. (Anglo American plc, 29%)	Venetia Mine in Northern Province	8,100.
Do.	do.	do.	Finsch Mine, 100 kilometers west of Kimberley	2,400.
Do.	do.	do.	Kimberley Mines, Kimberley	1,800.
Do.	do.	do.	Cullinan Mine	1,100.
Do.	do.	do.	Namaqualand Mine, 50 kilometers north of Port Nolloth	920.
Do.	do.	do.	The Oaks	120.
Do.	do.	Petra Diamonds Ltd.	Helam, Sedibeng, and Star Mines	175.
Do.	do.	do.	Koffiefontein Mine, 70 kilometers south of Kimberley	140.
Do.	do.	Trans Hex Group Ltd.	Baken, Bloeddrif, Reuning, and Saxendrift Mines	140.[e]

See footnotes at end of table.

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TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006[1]

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Fluorspar		Witkop Fluorspar Mine (Pty) Ltd. (subsidiary of Sallies Ltd.)	Witkop Mine, 250 kilometers west of Johannesburg	180.
Do.		Vergenoeg Mining Corp. (Pty) Ltd. [Metorex Pty. Ltd., 70%, and Minerales y Productos Derivados SA (Spain), 30%]	Vergenoeg Mine, 75 kilometers north of Pretoria	120.
Do.		Van den Heever Fluorspar Works	Van Den Heever Mine, 120 kilometers west of Johannesburg	50 metallurgical-grade fluorspar.[e]
Gold:				
Mine		AngloGold Ashanti Ltd. (Anglo American plc, 41.8%)	Vaal River operations:	
			Kopanang Mine	5,000 ore.
Do.	kilograms	do.	do.	35,000 gold.
Do.		do.	Great Noligwa Mine	2,700 ore.
Do.	kilograms	do.	do.	22,000 gold.
Do.		do.	Tau Lekoa Mine	5,000 ore.
Do.	kilograms	do.	do.	19,000 gold.
Do.		do.	Vaal River surface operations	5,800 ore.
Do.	kilograms	do.	do.	3,000 gold.
Do.	do.	do.	Moab Khotsong Mine	1,400 gold.
Do.		do.	West Wits operations:	
			Tau Tona Mine	3,100 ore.
Do.	kilograms	do.	do.	32,000 gold.
Do.		do.	Savuka Mine	3,000 ore.
Do.	kilograms	do.	do.	23,000 gold.
Do.		do.	Mponeng Mine	1,900 ore.
Do.	kilograms	do.	do.	19,000 gold.
Do.		Gold Fields Ltd.	Kloof Mine	3,840 ore.
Do.	kilograms	do.	do.	31,000 gold.
Do.		do.	Driefontein Mine	7,140 ore.
Do.	kilograms	do.	do.	59,000 gold.
Do.		do.	Beatrix Mine	4,920 ore.
Do.	kilograms	do.	do.	27,000 gold.
Do.		Western Areas Ltd. (JCI Gold, 50%, and Gold Fields Ltd., 50%)	South Deep Mine	2,700 ore.
Do.	kilograms	do.	do.	16,000 gold.
Do.		Harmony Gold Mining Co. Ltd.	Randfontein Mine	6,000 ore.
Do.	kilograms	do.	do.	31,000 gold.
Do.		do.	Free State operations	5,280 ore.
Do.	kilograms	do.	do.	24,000 gold.
Do.		Freegold Joint Venture (Harmony Gold Mining Co. Ltd., 50%, and African Rainbow Minerals Ltd., 50%)	Freegold operations	5,040 ore.
Do.	kilograms	do.	do.	15,000 gold.
Do.		Harmony Gold Mining Co. Ltd.	Elandskraal Mines	1,680 ore.
Do.	kilograms	do.	do.	12,000 gold.
Do.		do.	Evander operations	1,776 ore.
Do.	kilograms	do.	do.	11,000 gold.
Do.		do.	Target Mine	1,260 ore.
Do.	kilograms	do.	do.	8,000 gold.
Do.		do.	Kalgold Mine	1,560 ore.
Do.	kilograms	do.	do.	1,700 gold.
Do.		do.	Orkney and Welkom Mines	NA.

See footnotes at end of table.

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TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006[1]

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Gold--Continued:				
Mine--Continued		Durban Roodeport Deep Ltd.	Blyvooruitzicht and Doornfontein section	4,800 ore.
Do.	kilograms	do.	do.	6,900 gold.
Do.		do.	Crown section–tailings retreatment	11,760 ore.
Do.	kilograms	do.	do.	4,700 gold.
Do.		do.	East Rand Proprietary Mine	1,800 ore.
Do.	kilograms	do.	do.	2,500 gold.
Do.		Thistle Mining, Inc.	President Steyn Gold Mines in Free State	1,200 ore.
Do.	kilograms	do.	do.	7,800 gold.
Do.	do.	Barberton Mines Ltd. [Metorex Ltd., 54%, and Shanduka Resources (Pty) Ltd., 26%]	Eastern Transvaal Consolidated Division (Fairview, New Consort, and Sheba Mines)	3,200.[e]
Refined	metric tons	Rand Refinery Ltd.	Germiston, Gauteng Province	1,200.
Do.	do.	Harmony Gold Mining Co. Ltd.	Musuku Beneficiation Systems	100.
Iron and steel:				
Iron ore		Kumba Iron Ore Ltd.	Sishen Mine at Sishen	28,000.
Do.		do.	Thabazimbi Mine at Thabazimbi	2,400.
Do.		Assmang Ltd.	Beeshoek Mine near Postmasburg	6,000.
Do.		Highveld Steel and Vanadium Corp. Ltd. (Anglo American plc, 79%)	Mapochs Mine at Roossenekal, 60 kilometers west of Lydenburg	2,450.
Do.		Xstrata plc	Rhovan Mine at Brits	400.
Do.		Vametco Minerals Corp. (Strategic Minerals Corp., 100%)	Krokodilkraal Mine and plant near Brits	180.
Ferroalloys		Xstrata plc, 79.5%, and Merafe Resources Ltd., 20.5%	Wonderkop	553 ferrochromium.
Do.		do.	Rustenburg	430 ferrochromium.
Do.		Xstrata plc, 69.6%	Lydenburg	396 ferrochromium.
Do.		Xstrata plc, 79.5%, and Merafe Resources Ltd., 20.5%	Lion plant at Steelpoort	360 ferrochromium.
Do.		do.	Boshoek	240 ferrochromium.
Do.		Samancor Chrome Division (Kermas Group Ltd., 100%)	Ferrometals plant at Witbank	415 ferrochromium.
Do.		do.	Tubatse Ferrochrome plant at Steelpoort	340 ferrochromium.
Do.		do.	Middelburg Ferrochrome plant, 35 kilometers east of Witbank	235 ferrochromium.
Do.		Hernic Ferrochrome (Pty) Ltd. (Mitsubishi Corp., 51%)	Plant at Brits	420 ferrochromium.
Do.		Assmang Ltd.	Machadadorp plant in Mpumalanga Province	290 ferrochromium.
Do.		Merafre Resources Ltd. (Royal BafoKeng Nation, 33.2%, and Industrial Development Corporation of South Africa Ltd., 25.2%)	Smelter at Boshoek, North West Province	235 ferrochromium.
Do.		ASA Metals (Pty) Ltd. (Eastern Asia Metal Investment Co. Ltd., 60%, and Northern Province Development Corp., 40%)	Plant near Pietersburg, Northern Province	120 ferrochromium.
Do.		Samancor Manganese Division (BHP Billiton Plc, 54.6%; Anglo American plc, 28.9%; other private, 16.5%)	Metalloys Ltd. plant at Meyerton; can switch between ferromanganese and silicomanganese	560 high-carbon ferromanganese; 200 silicomanganese.
Do.		Assmang Ltd.	Cato Ridge plant in KwaZulu Natal Province	300 ferromanganese.
Do.		Samancor Manganese Division, 100%	Furnace at Samancor's Meyerton plant	75 ferromanganese.
Do.		Transalloys Division (Highveld Steel and Vanadium Corp. Ltd., 100%)	Plant at Witbank	45 medium-carbon ferromanganese.
Do.		do.	do.	170 silicomanganese.
Do.		Silicon Technology Pty Ltd.	NA	55 ferrosilicon.

See footnotes at end of table.

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TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006[1]

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Iron and steel--Continued:			
Ferroalloys--Continued	Highveld Steel and Vanadium Corp.	Rand Carbide plant	55 ferrosilicon.
Do. metric tons	do.	Plant at Witbank	12,500 ferrovanadium.
Do. do.	Xstrata plc	Rhovan plant at Brits	7,800 ferrovanadium.
Do. do.	Vametco Minerals Corp. (Strategic Minerals Corp., 100%)	Smelter near Brits	5,250 ferrovanadium.
Steel	Mittal Steel South Africa Ltd.	Newcastle, Saldanha, Vanderbijlpark, and Vereeniging plants	7,100 crude steel.
Do.	Highveld Steel and Vanadium Corp. Ltd. (Anglo American plc, 79%)	Witbank	1,000 iron; 1,000 crude steel.
Do.	Columbus Stainless (Pty) Ltd. (Acerinox SA, 76%)	Stainless steel plant at Middelburg	750 crude steel.
Do.	Scaw Metals Division (Anglo Operations Ltd.)	Germiston plant, Johannesburg	600 crude steel.
Do.	Davsteel Division (Cape Gate Pty. Ltd.)	Vanderbijlpark plant, Gauteng	480 crude steel; 480 billet.
Do.	Cape Town Iron & Steel Works (Pty) Ltd.	Kuilsrivier plant, Cape Town	250 crude steel; 250 billet.
Do.	Duferco Steel Processing Ltd.	Cold-rolled slab steel at Saldanha Bay	240 rolled steel.
Lead	Black Mountain Mineral Development Co. (Pty) Ltd.	Black Mountain Mine near Aggeneys	54 lead in concentrate.
Lime	PPC Lime Ltd (subsidiary of Pretoria Portland Cement Company Ltd.)	Plant at Lime Acres	1,200.
Do.	Idwala Lime (Idwala Industrial Holdings)	Plant at Daniëlskuil	1,000.
Do.	Inca Lime (Pty) Ltd. (subsidiary of Inca Mining (Pty) Ltd.)	Plant at Immerpan, Limpopo Province	100.
Manganese	Assmang Ltd.	Nchwaning Mine near Black Rock	3,000 ore.
Do.	do.	Gloria Mine near Black Rock	600 ore.
Do.	Samancor Manganese (Pty) Ltd. (BHP Billiton Plc, 60%, and Anglo American plc, 40%)	Mamatwan and Wessels Mines near Hotazel	3,400 ore.
Do.	Metmin (Metorex Pty. Ltd., 100%)	Open pit mine in North West Province	24 manganese dioxide.
Do.	Manganese Metal Co. Pty. Ltd. (BHP Billiton Plc, 51%)	Electrolytic plant at Nelspruit	30 manganese metal.
Do.	do.	Electrolytic plant at Krugersdorp	20 manganese metal.
Nickel	Anglo American Platinum Corp. Ltd.	Amandebult, Rustenburg, and Union sections; and Bafokeng Rasimone, Lebowa, Modikwa, Potgietersrust, and Western Limb Mines	24 mine.[e]
Do.	do.	Rustenburg Base Metal Refiners	22 refined.[e]
Do.	Impala Platinum Ltd.	Impala Mines	8 mine.[e]
Do.	do.	Impala Refining Services	10 refined[e]
Do.	do.	Base Metals Refinery	14 refined.[e]
Do.	Lonmin plc	Marikana Mines (Eastern Platinum, Karee, and Western Platinum) near Rustenburg and Limpopo Mine	5 mine.[e]
Do.	do.	Base Metals Refinery	5 refined.[e]
Do.	Nkomati Joint Venture (African Rainbow Minerals Ltd., 50%, and LionOre Mining International Ltd., 50%)	Nkomati Mine in Mpumalanga Province	5 mine.
Petroleum:			
Crude thousand 42-gallon barrels	Petroleum Oil and Gas Corporation of South Africa, 55%, and Pioneer Natural Resources Company, 45%	Pioneer offshore field	21,900.
Do. do.	Petroleum Oil and Gas Corporation of South Africa	Oribi field, 140 kilometers southwest offshore from Mossel Bay	9,100.
Do. do.	do.	Oryx field	4,400.

See footnotes at end of table.

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TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006[1]

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petroleum--Continued:				
Refined	thousand 42-gallon barrels	Shell and BP Refineries Pty. Ltd. (Shell SA Energy, 50%, and BP Southern Africa, 50%)	Sapref refinery in Durban	63,900.
Do.	do.	Engen Ltd. (62%)	Engen refinery in Durban	54,800.
Do.	do.	Caltex Oil SA Pty. Ltd. (private, 100%)	Calref refinery in Cape Town	40,200.
Do.	do.	National Petroleum Refiners of South Africa Pty. Ltd. (Sasol Ltd., 63.6%)	Natref refinery in Sasolburg	32,000.
Phosphate rock		Phosphate Development Corp. Ltd. (Foskor Ltd.) (Industrial Development Corp., 100%)	Foskor Mine and plant at Phalaborwa	3,850 phosphate rock.[3]
Do.		Fer-Min-Ore Ltd.	Plant at Germiston	30.
Do.		do.	Plant at Isithebe	12.
Platinum-group metals		Anglo American Platinum Corp. Ltd.	Rustenburg section near Rustenburg	12,420 ore.
Do.	kilograms	do.	do.	20,000 platinum; 8,800 palladium; 2,200 rhodium.
Do.		do.	Amandelbult section, 50 kilometers south of Thabazimbi mines	4,080 Merensky ore. 2,640 UG2 ore.
Do.	kilograms	do.	do.	19,000 platinum; 8,900 palladium; 2,200 rhodium.
Do.		do.	Union section, 50 kilometers south of Thabazimbi	6,000 ore.
Do.	kilograms	do.	do.	10,000 platinum; 4,600 palladium; 1,600 rhodium.
Do.		Bafokeng Rasimone Platinum Mine (Anglo American Platinum Corp. Ltd., 50%, and Royal Bafokeng Nation, 50%)	Bafokeng Rasimone Mine in Northern Province	2,400 ore.
Do.	kilograms	do.	do.	12,000 platinum; 5,200 palladium; 730 rhodium.
Do.	do.	Kroondal Platinum Mines (Anglo American Platinum Corp. Ltd., 50%, Aquarius Platinum Ltd, 25.5%)	Kroondal Mine	9,300 platinum; 4,600 palladium; 1,700 rhodium.
Do.		Modikwa Platinum Mine (Anglo American Platinum Corp. Ltd., 50%, and African Rainbow Minerals, 50%)	Modikwa Mine	2,400 ore.
Do.	kilograms	do.	do.	8,600 platinum; 8,400 palladium; 1,600 rhodium.
Do.		Anglo American Platinum Corp. Ltd.	Potgietersrust Platinum Mine	4,620 ore.
Do.	kilograms	do.	do.	5,800 platinum; 6,500 palladium; 390 rhodium.
Do.		do.	Lebowa Platinum (Atok) Mine, 70 kilometers east of Potgietersrus	960 Merensky ore. 600 UG2 ore.
Do.	kilograms	do.	do.	3,200 platinum; 2,200 palladium; 350 rhodium.
Do.		do.	Western Limb Mine	5,400 ore.
Do.	kilograms	do.	do.	1,500 platinum; 590 palladium; 100 rhodium.

See footnotes at end of table.

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TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006[1]

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Platinum-group metals--Continued		Anglo American Platinum Corp. Ltd.	Polokwane smelter	650 concentrate.
Do.		do.	Mortimer smelter	600 concentrate.
Do.		do.	Waterval smelter	200 concentrate.
Do.	kilograms	do.	Mortimer, Polokwane, and Waterval smelters	110,000 platinum; 60,000 palladium; 15,000 rhodium.
Do.	do.	do.	Precious Metals Refinery	110,000 platinum metal; 60,000 palladium metal; 15,000 rhodium metal.
Do.		Impala Platinum Ltd. (Impala Platinum Holdings Ltd., 100%)	Impala Mines, near Rustenburg in North West Province	17,000 ore.
Do.	kilograms	do.	do.	36,000 platinum; 16,000 palladium; 4,100 rhodium.
Do.		Impala Platinum Ltd.	Marula Mine	2,200 ore.
Do.	kilograms	do.	do.	2,800 platinum; 2,800 palladium; 580 rhodium.
Do.	do.	do.	Smelter	62,000 platinum; 29,000 palladium; 7,200 rhodium.
Do.	do.	do.	Precious metals refinery, near Springs in Guateng Province	62,000 platinum metal; 29,000 palladium metal; 7,200 rhodium metal.
Do.		Lonmin plc	Marikana Mines (Eastern Platinum, Karee, and Western Platinum) near Rustenburg)	14,400 ore.[e]
Do.	kilograms	do.	do.	30,000 platinum; 14,000 palladium; 4,300 rhodium.[e]
Do.		do.	Limpopo Mine	1,000 ore.[e]
Do.	kilograms	do.	do.	1,800 platinum; 1,400 palladium; 280 rhodium.[e]
Do.	do.	do.	Precious Metals Refinery at Western Platinum	31,000 platinum metal; 14,000 palladium metal; 4,000 rhodium metal.
Do.		Marikana Platinum Mine (Anglo American Platinum Corp. Ltd., 50%, Aquarius Holdings Ltd, 20%)	Marikana Mine	3,000 ore.
Do.	kilograms	do.	do.	4,000 platinum; 1,900 palladium; 670 rhodium.
Do.		Everest South Platinum Mine (Aquarius Platinum Ltd., 50.5%, Impala Platinum Holdings Ltd, 20%)	Everest South Mine	3,000 ore.
Do.	kilograms	do.	do.	3,300 platinum; 1,900 palladium; 500 rhodium.
Do.	do.	Northam Platinum Ltd. (Anglo American Platinum Corp. Ltd., 22.5%, and Mvelaphanda Resources Ltd., 21.9%)	Northam Mine, 20 kilometers south of Thabazimbi	1,800 Merensky ore. 900 UG2 ore.
Do.	do.	do.	do.	7,900 platinum; 3,800 palladium; 700 rhodium.

See footnotes at end of table.

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TABLE 2--Continued
SOUTH AFRICA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006[1]

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Pyrophyllite		Idwala Industrial Minerals (Benoni)	Ottsdal Mine in North West Province	15.
Do.		Wonderstone Ltd. (The Associated Ore & Metals Corp. Ltd.)	Pyrophylite (wonderstone) mine, North West Province	NA.
Do.		G&W Base and Industrial Minerals Pty. Ltd.	Piet Retief Mine	NA.
Silicon		Silicon Smelters (Pty) Ltd. (Anglo American plc; BHP Billiton Plc; Pechiney Metallurgie)	Polokwane plant, near Pietersburg, Limpopo Province	45 silicon metal.
Silver	metric tons	Rand Refinery Ltd.	Germiston, Gauteng Province	200 refined silver.
Synthetic fuels	thousand 42-gallon barrels	Sasol Ltd.	Coal to oil plant at Secunda and a coal to petrochemical plant at Sasolburg	54,800.
Do.	do.	Petroleum Oil and Gas Corporation of South Africa	Natural gas to petroleum products plant at Mossel Bay	18,300.
Tantalum	metric tons	Titan Processors (Pty) Ltd. (subsidary of Pinnacle Resources Inc.)	Plant at Johannesburg	360 tantalum oxide.
Titanium:				
Titanium concentrates		Richards Bay Minerals (Rio Tinto Plc., 50%, and BHP Billiton Plc, 50%)	Open cast operations, near Richards Bay	1,280 ilmenite; 125 rutile.[e]
Do.		Namakwa Sands Ltd. (Anglo Operations Ltd., a subsidiary of Anglo American plc, 100%)	Mine near Brand-se-Baai and mineral separation plant at Koekenaap	540 ilmenite; 25 rutile.
Do.		Exxaro Resources Ltd.	Hillendale Mine near Richards Bay, KwaZulu Natal Province	550 ilmenite; 20 rutile; 5 leucoxene.
Titanium slag		Richards Bay Iron and Titanium (Pty) Ltd./ Richards Bay Minerals (Rio Tinto Plc.)	Smelter at Richards Bay	1,000 titanium slag; 110 rutile.
Do.		Namakwa Sands Ltd.	Smelter at Vredenberg, Saldanha Bay area	200 titanium slag.
Do.		Highveld Steel and Vanadium Corp. Ltd.	Steel plant at Witbank	48 titanium slag.[e]
Do.		Exxaro Resources Ltd.	Empangeni smelter near Richards Bay, KwaZulu Natal Province	250 titanium slag.
Uranium oxide	metric tons	AngloGold Ashanti Ltd.	Vaal Rivers operation, near Klerksdorp	3,000.
Vanadium pentoxide	do.	Highveld Vanadium and Chemicals Division (Anglo American plc through Highveld Steel and Vanadium Corp. Ltd.)	Mapochs Mine near Lydenburg	17,500.
Do.	do.	do.	Plant at Witbank	10,800.
Do.	do.	Xstrata plc	Rhovan Mine at Brits	10,600.
Do.	do.	Vametco Minerals Corp. (Strategic Minerals Corp., 100%)	Krokodilkraal Mine and plant near Brits	5,400.
Do.	do.	Transvaal Alloys Pty. Ltd. (Highveld Steel and Vanadium Corp., 100%)	Wapadskloof Mine and plant, 60 kilometers northeast of Middelburg	2,250.[e]
Vermiculite		Palabora Mining Co. Ltd.	Palabora Mine and plant at Phalaborwa	223.
Zinc		Zinc Corp. of South Africa Ltd. (Exxaro Resources Ltd., 100%)	Struisbult Springszinc refinery at Springs, southeast of Johannesburg	110 refined zinc; 170 sulfuric acid.
Do.		Black Mountain Mineral Development Co. (Pty) Ltd.	Black Mountain Mine near Aggeneys	41 zinc in concentrate.
Zirconium		Tisand (Pty) Ltd./Richards Bay Minerals	Open cast mines near Richards Bay	300 zircon in concentrate.
Do.		Namakwa Sands Ltd.	Mine near Brand-se-Baai and mineral separation plant at Koekenaap	125 zircon in concentrate.
Do.		Exxaro Resources Ltd.	Hillendale Mine near Richards Bay, KwaZulu Natal Province	45 zircon in concentrate.
Do.		Palabora Mining Co. Ltd.	Palabora Mine and plant at Phalaborwa	14 baddeleyite.[e]
Do.		do.	Zirconium sulfate plant at Phalaborwa	8 zirconium sulfate.
Do.		Phosphate Development Corp. Ltd. (Foskor Ltd.) [Industrial Development Corp. Ltd. (IDC), 100%]	Plant at Phalaborwa	8 baddeleyite.[e]
Do.		do.	Fused zirconia plant	6 synthetic zirconia.

[e]Estimated. NA Not available.
[1]Based on information available as of February 2008.
[2]Source: American Bureau of Metal Statistics.
[3]Most of Foskor's phosphate output is from phosphate concentrates supplied by the neighboring Palabora copper mine.

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TABLE 3
SOUTH AFRICA: RESERVE BASE OF MAJOR MINERALS IN 2006[1]

(Million metric tons unless otherwise specified)

Commodity		Reserve base
Andalusite[2]		51
Antimony	thousand metric tons	200
Chromium, ore		5,500
Coal, recoverable		27,981
Cobalt	thousand metric tons	15
Copper		13
Fluorspar		80
Gold	thousand metric tons	36
Iron ore		1,894
Lead		3
Manganese, ore		4,000
Nickel		12
Phosphate rock, concentrates		2,500
Platinum-group metals	thousand metric tons	70
Titanium minerals		220
Uranium	thousand metric tons	341
Vanadium		12
Vermiculite		80
Zinc		15
Zirconium		14

[1]Metallic minerals are contained metal.
[2]Includes the aluminosilicate and sillimanite.

Source: Mwape, P., Roberts, M.J., Mokwena, E., Musi, L., Tjatjie, T., Phale, M., Baloyi, R., Mailula, D.T., and Kwata, P.G., 2007, General review, *in* South Africa's Mineral Industry 2006/2007: Johannesburg, South Africa, Department of Minerals and Energy of the Republic of South Africa, 27 p.

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THE MINERAL INDUSTRY OF SUDAN

By Thomas R. Yager

In Sudan, rising production of crude petroleum in recent years has substantially increased the mineral sector's influence on the national economy. Sudan was not a globally significant producer or consumer of mineral commodities in 2006. Investment in Sudan's petroleum and petrochemical industries by U.S. individuals or organizations was banned by Executive Order 13412 issued by the President of the United States in October 2006. The alleged use of revenues from petroleum sales to finance operations in the Darfur conflict constituted one of the reasons for issuing the Order (Reuters Ltd., 2006).

Minerals in the National Economy

In 2006, the petroleum sector accounted for 15.2% of the gross domestic product; manufacturing, 6.9%; and mining and quarrying, 0.6%. The value of output in the petroleum sector grew by 10% in 2006, and mining and quarrying, by 5%. Crude petroleum exports amounted to $4.7 billion, or 83% of total exports; petroleum products, 7%; and gold, 1% (Bank of Sudan, 2007).

Production

In 2006, the production of crude petroleum increased by 25%, and refined petroleum products, by 23%. Cement output declined by 39%, and gold, by 13% (table 1).

Structure of the Mineral Industry

Sudan's crude petroleum was produced by joint ventures of Chinese, Indian, Malaysian, and Sudanese state-owned companies. Most of the petroleum refineries were also state-owned; the Khartoum Oil Refinery was a joint venture between Chinese and Sudanese state-owned companies. The Government owned a 56% share in the Hassai gold mine; LaMancha Resources Inc. purchased the 40% share held by Ariab Mining Company Ltd. in early 2006. The cement plants were privately owned (La Mancha Resources Inc., 2007).

Commodity Review

Metals

Gold.—La Mancha produced 3,158 kilograms (kg) of gold at the Hassai Mine compared with 3,625 kg in 2005. Production declined in 2006 because of lower ore grades and gold recoveries from silico-baritic ores and the breakdown of equipment. In 2007, the company expected to produce about 3,400 kg of gold (La Mancha Resources Inc., 2007).

Industrial Minerals

Cement.—In 2006, national cement production declined to 202,200 metric tons (t) from 331,200 t in 2005. Production at Atbara decreased to 114,200 t in 2006 from 240,000 t in 2005 because of shutdowns for maintenance; production at Rabak decreased to 88,000 t from 91,100 t. Al-Rajhi Group of Saudi Arabia was conducting a feasibility study on increasing the capacity of the Atbara plant by 1.8 million metric tons per year (Mt/yr). Nile Cement Company Ltd. planned to increase the capacity of the Rabak plant to 500,000 metric tons per year (t/yr) from 150,000 t/yr and to build a new plant with a capacity of 1.1 Mt/yr. Star Cement of the United Arab Emirates was conducting a feasibility study on a new plant near Khartoum with a capacity of 660,000 t/yr (Middle East Economic Digest, 2006a-c; Bank of Sudan, 2007).

Mineral Fuels

Petroleum.—In 2006, crude petroleum production increased to an estimated 158 million barrels (Mbbl) from 126 Mbbl in 2005 and 111 Mbbl in 2004. The increase was attributable to higher production from Block 6 and the start of production in Blocks 3, 5A, and 7.

The Greater Nile Petroleum Operating Co. [a joint venture of China National Petroleum Corp. (CNPC) (40%), Petronas Carigali Overseas Shd. Bhd. of Malaysia, (30%), ONGC Videsh Ltd. of India (25%), and Sudan Petroleum Company Ltd. (Sudapet) (5%)] produced crude petroleum at Blocks 1, 2, and 4 in south central Sudan. In 2006, production in Blocks 1, 2, and 4 declined to an estimated 316,000 barrels per day (bbl/d) from 328,000 bbl/d in 2005. Output was expected to increase to 318,000 bbl/d in 2007 before declining to 308,000 bbl/d in 2009 and 250,000 bbl/d in 2011 (Wesselink, 2006).

CNPC held Block 6, which was located to the northwest of Muglad. In 2006, production in Block 6 increased to an estimated 33,000 bbl/d from 18,000 bbl/d in 2005. Output was expected to increase to 69,000 bbl/d in 2007 and 92,000 bbl/d in 2009 before declining to 72,000 bbl/d in 2011 (Wesselink, 2006).

Blocks 3 and 7 in eastern Sudan were held by the Petrodar Consortium [CNPC (41%), Petronas (40%), Sudapet (8%), Gulf Petroleum Company of Qatar (6%), and the Al-Thani Group of Sudan (5%)]. In August 2006, production started in Blocks 3 and 7 at a rate of 150,000 bbl/d; output was expected to increase to 180,000 bbl/d in 2007 (Wesselink, 2006).

Blocks 5A and 5B were located in the Muglad Basin. Block 5A was held by White Nile Petroleum Operating Co. [Petronas (68.9%), ONGC Videsh (24.1%), and Sudapet (7%)]; reserves at the Thar Jath field in Block 5A were reported to be 250 Mbbl. Block 5B was held by Petronas (39%), Lundin Petroleum AB of Sweden (24.5%), ONGC Videsh (23.5%), and Sudapet (13%). In June 2006, production started in Block 5A at a rate of 40,000 bbl/d. Output was expected to increase to 50,000 bbl/d in 2007 and 54,000 bbl/d in 2009 before declining to 39,000 bbl/d in 2011 (Wesselink, 2006).

Kuwait Petroleum Corp., Marathon Oil Corp., and Total S.A. held Block B in southern Sudan. In December 2006, the central

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Government announced that White Nile Ltd. of the United Kingdom, which had been granted the right to explore Block B by the governing authorities of Southern Sudan, would be forced to relinquish control to Total and its joint-venture partners (Dow Jones Newswire, 2006).

Block C, which is located to the southwest of Block 6 in western Sudan, was held by the Advanced Petroleum Company [Hi-Tech Petroleum of Sudan (65%), Sudapet (17%), the government of the State of Khartoum (10%), Heglieg Petroleum (8%)]. Cliveden Petroleum Company of Switzerland sold its 37% interest in Block C to High Tech Group because the companies drilled five dry wells in 2005 and 2006 (Africa Energy Intelligence, 2005; Wesselink, 2006).

Sudapak Operating Company [Zaver Petroleum Corp. Ltd. of Pakistan, 85%; Sudapet, 15%] held Block 9 in the vicinity of Khartoum; Block 11 in the States of Gezira, North Kordofan, Northern, and White Nile to the west of Block 9; and Block A in Southern Sudan near Blocks 1, 2, 5A, 5B, 7, and B. Block 14 in northwestern Sudan was held by the state-owned company PetroSA (Pty) Ltd. of South Africa and Sudapet. The Red Sea Petroleum Operating Company [CNPC, 35%; Petronas, 35%; Sudapet, 15%] held Block 15 on the Red Sea between Port Sudan and the border with Eritrea. At the end of 2006, Block 10 in the State of Gedara, Block 12B in the State of Darfur, and Block 13 on the Red Sea remained unawarded.

In 2006, Sudan's output of petroleum products increased to 31.6 Mbbl from 25.6 Mbbl in 2005. The Khartoum Oil Refinery, which was operated by CNPC, accounted for a majority of the country's refining capacity. In July, CNPC announced that it had increased the refinery's capacity to 100,000 bbl/d. In late 2005, the Government signed a joint-venture agreement with Petronas to develop a new refinery at Port Sudan with a capacity of 150,000 bbl/d. The refinery was expected to be completed in early 2009 (Middle East Economic Digest, 2006d; Peng, 2006).

Outlook

Crude petroleum production could increase to 617,000 bbl/d in 2007 and 634,000 bbl/d in 2009 because of higher production in Blocks 3, 5, 6, and 7 before declining to 541,000 bbl/d in 2011 because of lower output from Blocks 1, 2, and 4 (Wesselink, 2006). The development of Block 12A depended on resolution of the conflict in Darfur. Cement production capacity could increase by as much as 3.9 Mt/yr; the production of other construction materials also could increase substantially. Little change was expected for chromite, gold, and silver production.

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TABLE 1
SUDAN: PRODUCTION OF MINERAL COMMODITIES[1]

Commodity[2]		2002	2003	2004	2005	2006
Cement, hydraulic	metric tons	204,800	271,900	307,100	331,200 r	202,200
Chromite, mine output, gross weight[3]	do.	14,000	37,000	26,000	21,654 r	22,000 e
Gold, mine output, Au content[4]	kilograms	5,239	5,106	5,000	3,625 r	3,158
Gypsum e	metric tons	4,540 [5]	13,304 [5]	14,000	14,000	15,000
Marble	cubic meters	22,000 [5]	23,000 r	24,000 r	24,000 r	26,000
Petroleum:						
Crude, including lease condensate	thousand 42-gallon barrels	90,200 r	98,500 r	111,000 r	126,000 r	158,000 e
Refinery products:						
Liquefied petroleum gas	do.	2,792	2,658	3,235	3,010 r	3,742
Gasoline	do.	7,546	7,318	8,109	7,827 r	9,717
Naphtha	do.	303	260	248	248 r	216
Jet fuel	do.	1,339	1,236	1,562	1,596 r	1,445
Kerosene	do.	259	282	294	340 r	320
Distillate fuel oil	do.	7,631	8,241	9,708	9,965 r	13,554
Residual fuel oil	do.	1,991	2,503	2,444	2,589 r	2,566
Total	do.	21,861	22,498	25,600	25,575 r	31,560
Salt e	metric tons	83,340 [5]	61,096 [5]	63,000 r	65,000 r	68,000
Silver e	kilograms	3,256 [5]	2,844 [5]	2,800 r	2,000 r	1,800
Steel, semimanufactured	metric tons	53,035	63,936	35,740	67,015 r	67,000 e

eEstimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. rRevised.

[1]Table includes data available through July 25, 2007.

[2]In addition to the commodities listed, the following are presumably produced although available information is inadequate to estimate output: clay and/or shale for cement manufacture (normally about 0.4 metric ton of clay and/or shale per metric ton of finished cement); limestone for cement manufacture (normally at least 1.25 metric tons per metric ton of finished cement), agriculture, lime manufacture, and construction aggregate and fill; other construction materials (clays, sand and gravel, stone, and others for local use); and mica.

[3]Presumed to be ores and concentrates with an estimated average grade of about 54% chromic oxide.

[4]Does not include artisanal output.

[5]Reported figure.

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TABLE 2
SUDAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity
Cement		Al-Rajhi Group	Plant at Atbara	400,000
Do.		Nile Cement Company Ltd.	Plant at Rabak	150,000
Chromite		Ingessana Hills Mines Corp.	Mine at Ingessana Hills	48,000
Gold	kilograms	Compagnie Minière Or SA (Government of Sudan, 56%, and La Mancha Resources Inc., 40%)	Mine at Hassai	5,000
Gypsum		Sudanese Mining Corp. (Government, 100%)	Bir Eit Mine	15,000
Limestone		Atbara Cement Company Ltd.	Mine at Atbara	500,000
Do.		Nile Cement Company Ltd.	Mine at Rabak	200,000
Mica		Sudanese Mining Corp. (Government, 100%)	Mines at Sheriek	1,800
Petroleum:				
Crude	thousand 42-gallon barrels	Greater Nile Petroleum Operating Co. [China National Petroleum Corp. (CNPC), 40%; Petronas Carigali Overseas Shd. Bhd., 30%; ONGC Videsh Ltd., 25%; Sudan Petroleum Company Ltd. (Sudapet), 5%]	Blocks 1, 2, and 4	120,000
Do.	do.	Petrodar Consortium [China National Petroleum Corp. (CNPC), 41%; Petronas Carigali Overseas Shd. Bhd., 40%; Sudan Petroleum Company Ltd., 8%; Gulf Petroleum Company of Qatar, 6%; Al-Thani Group, 5%]	Blocks 3 and 7	73,300
Do.	do.	China National Petroleum Corp. (CNPC)	Block 6	14,600
Do.	do.	White Nile Petroleum Operating Co. [Petronas Carigali Overseas Shd. Bhd., 68.9%; ONGC Videsh Ltd., 24.1%; Sudan Petroleum Company Ltd. (Sudapet), 7%]	Block 5A	14,600
Refined	do.	Khartoum Oil Refinery [China National Petroleum Corp. (CNPC), 50%, and Sudan Petroleum Corp., 50%]	Refinery at Jali	36,500
Do.	do.	Port Sudan Refining Ltd. (Government, 100%)	Refinery at Port Sudan	9,100
Do.	do.	Government	Refinery at El Obeid	3,700
Do.	do.	Concorp Ltd.	Refinery at Shajirah	3,700
Do.	do.	Government	Refinery at Abu Jabra	730
Steel:				
Crude		Sudan Master Technology	Plant at Giad Industrial City	60,000
Rebar		do.	do.	150,000
Do.		Sudanese Steel Products Ltd. (subsidiary of Hafez Elsayad Barbary Ltd.)	Plant at Khartoum	150,000
Galvanized		do.	do.	20,000

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THE MINERAL INDUSTRY OF TANZANIA

by Thomas R. Yager

In 2006, Tanzania was the world's only producer of tanzanite. The country also played a significant role in the global production of gold, accounting for nearly 2% of the world's gold mine output. Other domestically significant mining and mineral processing operations included cement and diamond. Tanzania was not a globally significant consumer of minerals or mineral fuels (George, 2007).

Minerals in the National Economy

The manufacturing sector accounted for 6.5% of the gross domestic product, and mining and quarrying, 3.5%. The value of output in the mining sector grew by 16.4% in 2006 after rising by 15.7% in 2005. Formal employment in the mining sector amounted to about 8,000; an estimated 550,000 artisanal miners produced colored gemstones, diamond, gold, and other commodities (Mwamunyange, 2006; Bank of Tanzania, 2007a, p. 29, 35; Phillips, 2007).

Government Policies and Programs

The mining sector is regulated by the Mining Act of 1998, which, when enacted, simplified previous laws on mining and mineral trading. Tanzania is a signatory to the Kimberley Process, which is a certification system established to reduce the trade in conflict diamond.

Production

In 2006, the production of colored gemstones increased by 296%; gypsum, 41%; natural gas, 25%; diamond, 24%; and semimanufactured steel and silver, 16% each. Coal production decreased by 76%; salt, 32%; pozzolanic materials, 21%; limestone, 20%; and gold, 10%.

Structure of the Mineral Industry

Tanzania's gold mines were privately owned. The Government held minority interests in the privately owned Kiwira coal mine and Williamson diamond mine. In 2006, the Government sold its share in Tanzania Portland Cement Company Ltd. (TPCC). The Nyanza salt mines and the Minjingu phosphate mines were also owned by private investors. Artisanal miners accounted for most of the country's colored gemstone production; crushed stone, diamond, and gold were also produced by artisanal miners.

Mineral Trade

Gold exports increased in value to $737 million in 2006 from $656 million in 2005. In 2006, the share of gold in total exports was 44%; diamond, 1%; and colored gemstones, copper, silver, and other minerals combined, 2%. The Bank of Tanzania reported that imports of petroleum products increased in value to nearly $1.15 billion in 2006 from $847 million in 2005. Petroleum products accounted for 27% of the value of total imports, and fertilizers, 1% (Bank of Tanzania, 2007b, p. 22-23).

Commodity Review

Metals

Cobalt, Copper, and Nickel.—Barrick Gold Corp. of Canada produced copper as a coproduct at the Bulyanhulu gold mine. Reserves at Bulyanhulu were estimated to be nearly 160,000 metric tons (t) of contained copper (Barrick Gold Corp., 2007a, p. 133).

Barrick and Falconbridge Ltd. of Canada (50% each) had a joint venture for the exploration and development of the Kabanga nickel sulfide deposit in northwestern Tanzania. In 2006, Xstrata plc of Switzerland purchased Falconbridge. Resources at Kabanga were estimated to be 50.7 million metric tons (Mt) at a grade of 2.5% nickel. Xstrata spent $50 million on exploration and development by the end of 2006; the company planned to spend an additional $95 million on activities that included a prefeasibility study. Xstrata planned to complete the prefeasibility study in 2007 and, depending upon the results of the study, to complete a full feasibility study in late 2008 (Barrick Gold Corp., 2007a, p. 33, 135; Guardian, 2007).

Goldstream Mining NL of Australia explored for cobalt, copper, and nickel at the Mibango project near Lake Tanganyika and at the Luwumbu project near Lake Malawi in 2006. The company had joint-venture agreements with Lonmin plc of the United Kingdom for these projects; Albidon Ltd. of Australia also held a share in the Luwumbu project. Lonmin was required to complete feasibility studies at Luwumbu by the end of March 2009, and at Mibango, by the end of March 2012. Goldstream also explored at its Nachingwa nickel-copper-cobalt property in southeastern Tanzania in May 2006. In the second quarter of 2006, Albidon and BHP Billiton Ltd. of Australia explored at the former company's Songea nickel-platinum project, which comprised five prospecting licenses in southwestern Tanzania near Lake Malawi (Albidon Ltd., 2006; Goldstream Mining NL, 2006, p. 18, 20, 27).

Gold.—Tanzania's gold production declined to an estimated 47,000 kilograms (kg) in 2006 from 52,236 kg in 2005. The Buhemba, the Bulyanhulu, the Geita, the Golden Pride, the North Mara, and the Tulawaka Mines had a combined capacity to produce about 53,000 kilograms per year (kg/yr) of gold. Tanzania's resources amounted to about 1,600 t of contained gold, of which about 850 t was reserves (tables 1, 2, and 3).

Barrick operated the Bulyanhulu underground gold mine. In 2006, the Bulyanhulu Mine produced nearly 10,300 kg of gold compared with 9,700 kg in 2005. Barrick was engaged in an upgrade of its processing plant that was expected to increase gold recovery rates to about 91.5% from 87.5%. The cost of the project was estimated to be $27 million. Barrick also produced

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copper and silver as coproducts. The majority of gold was recovered from copper concentrates; the remainder was from gold doré (Mining Review Africa, 2006a; Barrick Gold Corp., 2007b).

Placer Dome Gold Inc. of Canada operated the North Mara open pit gold mine, which encompassed the Gokona, the Nyabigena, and the Nyabirama pits. Production at the North Mara Mine amounted to about 11,600 kg of gold compared with 7,788 kg in 2005. In January 2006, Placer Dome's board of directors approved a bid by Barrick to purchase the company (Placer Dome Gold Inc., 2006, p. 3, 5; Barrick Gold Corp., 2007b).

Barrick and its joint-venture partner Explorations Minières du Nord Ltée (MDN) of Canada started production at the Tulawaka open pit gold mine in March 2005. Production at Tulawaka increased to nearly 4,400 kg in 2006 (the mine's first full year of production) from 3,900 kg in 2005. Barrick and MDN were engaged in a feasibility study of underground mining at Tulawaka that could add 12 months to the life of the mine. In September 2006, MDN and its joint-venture partners Jope Business Associates and Lakota Resources Inc. of Canada conducted a drilling program at the Simba project, which is located north of the Tulawaka Mine. Barrick also engaged in a joint-venture agreement to explore near Tulawaka (Mining Review Africa, 2006a; African Mining, 2007; Barrick Gold Corp., 2007b).

Barrick completed a feasibility study on mining the Buzwagi deposit in 2006. The Government was expected to make a decision on the Environmental Impact Assessment for Buzwagi in the first quarter of 2007. If Barrick were to receive Government approval, construction of the mine was expected to start in late 2007 and production, in late 2009. Costs for the project were estimated to be $400 million. Barrick planned to produce between 7,500 and 7,800 kg/yr of gold; the life of the mine was expected to be at least 10 years (Barrick Gold Corp., 2007a, p. 32, 131-132; Guardian, 2007).

In 2006, Barrick's exploration activities were focused on the Nyanzaga project, which is located northeast of the Bulyanhulu Mine. Barrick had a joint-venture agreement with Sub-Sahara Resources NL of Australia to explore at Nyanzaga, which included the Tusker deposit. Resources at Tusker were estimated to be 123.3 Mt of ore at a grade of 1.15 grams per metric ton (g/t) (Mining Review Africa, 2006a; Resource Information Unit, 2007).

Geita Gold Mining Ltd. (a subsidiary of AngloGold Ashanti Ltd. of South Africa) operated the Geita open pit gold mine. The Geita Mine produced nearly 9,600 kg of gold in 2006 compared with about 19,100 kg in 2005; the decrease in production was mostly attributable to lower ore grades and heavy rains. In 2007, production at Geita was expected to increase to about 12,400 kg. In September, AngloGold Ashanti ended its joint-venture agreement to explore for gold at Kigosi (AngloGold Ashanti Ltd., 2007, p. 18, 80-81; Resource Information Unit, 2007).

Resolute Mining Ltd. of Australia owned the Golden Pride open pit mine. In fiscal year 2005-06, the Golden Pride Mine produced 4,511 kg of gold compared with 4,661 kg in fiscal year 2004-05. Lower production was attributable to a decrease in ore grades and recovery rates. In March 2006, Resolute increased its estimate of reserves at Golden Pride by about 22 t; the life of the mine was increased to about 8 years (Resolute Mining Ltd., 2006, p. 9-10).

Resolute explored for gold in the area near the Golden Pride Mine. Resolute also conducted drilling and completed a new resource study at the Nyakafuru project in May 2006; the Nyakafuru project was a joint venture with IAMGOLD Corp. of Canada (Resolute Mining Ltd., 2006, p. 19-21).

Gallery Gold Ltd. of Australia held the Buckreef/Rwamagaza and the Kitongo deposits; IAMGOLD purchased Gallery in early 2006. IAMGOLD planned to complete a feasibility study of the Buckreef/Rwamagaza project in mid-2007. If the study were to yield favorable results, IAMGOLD planned to start production in 2008; the mine was expected to produce nearly 4,400 kg/yr of gold. Resources at Buckreef/Rwamagaza amounted to nearly 61 t of contained gold (IAMGOLD Corp., 2006, p. 12, 22).

In March 2006, African Eagle Resources plc (AER) of the United Kingdom increased its estimate of resources at the Miyabi project to 16 t of contained gold from about 12 t. AER signed a joint-venture agreement with MDN to explore at AER's Msasa project in May. MDN agreed to invest $200,000 initially on exploration to earn a 51% interest in the project. Depending upon the results, MDN's share could increase to 65% after the company invests an additional $1.7 million in exploration by January 2010 and completes a feasibility study. MDN commenced drilling at Msasa in July (Resource Information Unit, 2007).

Tanzanian Royalty Exploration Corp. (formerly known as Tan Range Exploration Corp.) of the United States completed a drilling program at its Luhala Gold project in March 2006. The company also carried out a trenching program at the Kibara Gold project in February and March and commenced an exploration program at Kigosi in November (African Mining, 2006, 2007).

Currie Rose Resources Inc. of Canada and Sub-Sahara had joint-venture agreements to explore at the Jubilee Reef, the Mabale, and the Nyamirembe properties. In the first quarter of 2006, Sub-Sahara sold its interest in Jubilee Reef to Currie Rose. Currie Rose and Sub-Sahara explored at Mabale and Nyamirembe in 2006 (Resource Information Unit, 2007).

In 2006, Randgold Resources Ltd. engaged in drilling at its Kiabakari project. Randgold was re-evaluating the status of the project in November because of the lack of substantial mineralization. Shanta Gold Ltd. engaged in exploration at Singida in the third quarter of 2006. Midlands Minerals Corp. of Canada commenced a drilling program at its Itilima property in the Lake Victoria goldfield in late October. Coeur d'Alene Mines Corp. of the United States explored at Kiziba Hill and Saragurwa in the second half of 2006. Helio Resource Corp. of Namibia completed a drilling program at its Saza project in southwestern Tanzania in 2006. Lakota Resources started drilling at its Tembo project in July; the company planned to continue the program through the end of 2006 (African Mining, 2007; Resource Information Unit, 2007).

Platinum-Group Metals.—Goldstream explored for platinum-group metals (PGM) at the Mibango project near Lake Tanganyika and at the Luwumbu project near Lake Malawi. Goldstream's joint-venture partner Lonmin planned to spend $2.4 million on exploration at Luwumbu in 2006. Lonmin also planned to invest $2.1 million in Mibango (Goldstream Mining NL, 2006, p. 23, 30).

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Titanium and Zirconium.—Tiomin Resources Inc. of Canada acquired an exploration license for mineral sands that extended for about 90 kilometers along the Indian Ocean coastline. The Pangani and the Tajiri prospects were the principal zones of ilmenite, rutile, and zircon mineralization (African Mining, 2006).

Industrial Minerals

Cement.—In 2006, cement production increased to 1.42 Mt from nearly 1.37 Mt in 2005 and 900,000 t in 2001. National cement capacity amounted to approximately 1.47 million metric tons per year (Mt/yr). TPCC planned to spend about $100 million from mid-2006 to 2009 to increase its capacity to 1.2 Mt/yr from 670,000 metric tons per year (t/yr). TPCC's production supplied about 40% of domestic cement demand. Tanga Cement Company Ltd. was also considering an expansion of its capacity; the company's operations were affected by power blackouts and shortages of coal (Bank of Tanzania, 2007a, p. 40; HeidelbergCement AG, 2007a, b).

Diamond.—In 2006, national diamond production increased to 272,200 carats from 219,600 carats in 2005. Diamond recovery at the Williamson Mine remained nearly unchanged at 189,396 carats in 2006. DeBeers Group planned to increase production at the Williamson Mine by 20% in 2007 through greater efficiencies at the main ore treatment plant. In 2006, the company also completed a study of a new ore treatment plant that would increase capacity to 7 Mt/yr from 4 Mt/yr. Diamond production was expected to increase to 500,000 carats per year. Depending upon approval of the project, DeBeers planned to complete the new plant in July 2008 and to reach full production by the end of 2008 (Mining Review Africa, 2006b; Bank of Tanzania, 2007a, p. 43; DeBeers Group, 2007, p. 15).

El Hillal Minerals Ltd. produced diamond from alluvial deposits at Mwadui near the Williamson Mine. In 2006, the company produced 23,434 carats of diamond at a value of $4.45 million. El Hillal planned to produce 24,000 carats in 2007 (Mande, 2007).

Gemstones.—Tanzania produced a variety of gemstones that included amethyst, aquamarine, cordierite, emerald, garnet, ruby, sapphire, spinel, tanzanite, and tourmaline. In 2006, the total production of gemstones was about 2,490,000 kg compared with 628,000 kg in 2005 and 96,866 kg in 2001 (Bank of Tanzania, 2007a, p. 43).

Merelani, which is located near Arusha, was the world's only source of tanzanite. Artisanal and small-scale miners operating in Blocks B and D of the Merelani deposit accounted for most of the country's tanzanite production. Kilimanjaro Mines Ltd. and Tanzanite Africa Ltd. operated medium-scale mines in Block A and the Block D Extension, respectively. Production at Blocks B and D has declined in recent years as near-surface resources have been depleted and mine tunnels became intertwined. The artisanal and small-scale miners lacked the capital needed to buy equipment for deep underground mining (Kondo, 2007).

TanzaniteOne Ltd. of South Africa mined tanzanite in Block C; the company cut high-quality tanzanite at its lapidaries in South Africa and Tanzania. In 2006, TanzaniteOne produced 246 kg of rough tanzanite; lower output in the first half of the year was partially attributable to power shortages. The company planned to increase its production by about 24% in 2007 and by 15% per year from 2007 to 2010. The life of TanzaniteOne's mining operations was expected to be between 12 and 14 years; this figure was based on resources measured to a depth of 400 meters (m). In 2006, however, a drilling program discovered mineralization at a depth of 1,200 m (Mining Review Africa, 2007; TanzaniteOne Ltd., 2007, p. 14-15).

Tanzania had about 400 experienced gemstone cutters and 20 lapidaries in early 2005; the Tanzania Mineral Dealers Association (TAMIDA) planned to train and employ 5,000 tanzanite cutters by 2010. The financing of new lapidaries could require Government assistance. In July 2006, the Chair of TAMIDA reported that 80% of licensed tanzanite dealers owned 2 or 3 cutting and polishing machines (East African, 2005; Ihucha, 2006).

By March 2006, TanzaniteOne had opened a new lapidary in Arusha to cut high-quality tanzanite. The company planned to centralize its cutting and polishing operations at Merelani. TanzaniteOne planned to expand the Merelani facility from 8 cutters to 25 initially and to 200 as skilled workers and distribution channels became available (Bondia, 2006).

Tsavorite, which is a green grossular garnet that obtains its color from trace amounts of chromium and vanadium, was mined by Swala Gem Traders at the Komolo deposit (also known as the Lemshuko Mine). Swala engaged in mechanized mining of alluvial deposits.

Longido Ruby Zoisite Company Ltd. mined ruby and zoisite in the Arusha District. Mechanized ruby and sapphire mining was carried out by Tansta Mining Co. and World Gem Supplies Ltd. in the Songea District in the Ruvuma Region; artisanal miners also worked at these deposits. Ruby was also produced at Longido Mine in the Monduli District.

Artisanal and small-scale miners produced alexandrite and emerald sporadically at the Manghola and the Manyara deposits in the Mbulu District in north central Tanzania. The Manghola deposit was alluvial. Alexandrite was also produced at Tunduru, and emerald, in the Sumbawanga District. In October 2006, Douglas Lake Minerals Inc. of Canada announced that it had completed negotiations to acquire the Lake Manyara emerald and alexandrite property (Douglas Lake Minerals Inc., 2006).

Lime.—Athi River Mining Ltd. of Kenya produced lime for consumption in the gold mining industry at its plant in Tanga. The company planned to double its capacity to 40,000 t/yr in 2007 (Mogusu, 2006).

Mineral Fuels and Related Materials

Coal.—Kiwira Coal and Power Ltd. operated the Kiwira underground mine in Ileje District. Production declined sharply in 2006 because of mechanical problems. In 2006, the company announced plans to double the Kiwira Mine's capacity to 300,000 t/yr by 2008. The mine's output was expected to be consumed by a new coal-fired power station with a capacity of 200 megawatts (Fundisha, 2006; Tarimo, 2006).

Natural Gas.—Orca Exploration Group Inc. (formerly known as EastCoast Energy Corp.) produced natural gas from Songo Songo Island. In 2006, the company increased production to more than 500 million cubic meters from 408 million cubic

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meters in 2005. The gas-fired Ubungo Power Plant increased its consumption of natural gas to offset decreased generation by hydroelectric plants. Output was expected to increase to between 600 and 620 million cubic meters in 2007 and between 780 and 890 million cubic meters in 2008 because of higher demand from new gas-fired power stations and the Village Electrification Program. Orca planned to increase the capacity of its gas processing plant to more than 1.4 billion cubic meters per year from 720 million cubic meters per year (Orca Exploration Group Inc., 2007, p. 9-10, 21).

In December 2006, Artumas Energy (Tanzania) Ltd. (a subsidiary of Artumas Group Inc. of Canada) started production at its Mtwara energy project, which involved the development of natural gas resources in Mnazi Bay in southeastern Tanzania. Artumas commissioned the gas processing facilities in December and planned to commission a gas-fired power station at Mtwara in 2007 (Artumas Energy (Tanzania) Ltd., 2006).

Petroleum.—Aminex plc of the United Kingdom planned to drill at Nyuni in 2007 and at the Ruvuma Basin in southern Tanzania in 2008. Maurel et Prom of France drilled at the Rufiji and Mafia Block in 2006. Ophir Energy plc of South Africa signed production-sharing agreements with the Government for Blocks 3 and 4 in June. Petrobrás Group of Brazil held offshore Blocks 5 and 6 (Maurel et Prom, 2006; Ophir Energy plc, 2006; Aminex plc, 2007).

Uranium.—Uranex NL of Australia (Goldstream Mining NL, 39.5%) explored for uranium at its Lake Bahi and Mkuju properties in 2006; the company planned additional exploration that included drilling, geochemical surveying, and trenching at Mkuju starting in May 2007. In the second half of 2006, Uranium Resources plc of Australia conducted geologic mapping, radiometric surveys, surface sampling, and trench digging at its Mtonya project in southern Tanzania. Mantra Resources Ltd. of Australia held the Bahi North and the Mkuju River properties (African Mining, 2007; Resource Information Unit, 2007).

Outlook

Tanzania's mineral industry, particularly gold mining, is likely to grow in the near future. With increased production from the Geita Mine and the development of such projects as Buckreef and Buzwagi, Tanzania's gold production could rise to about 57 t in 2011. Diamond production could increase to more than 500,000 carats in 2009. Cement, lime, and natural gas output is also expected to increase. Artisanal tanzanite production is likely to decline because of resource depletion; it is unclear to what extent increased production by TanzaniteOne will offset the decline. The development of nickel resources depends heavily upon world market conditions.

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TABLE 1

TANZANIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004	2005	2006
Calcite[e]		40	40	40	40	40
Cement, hydraulic	thousand metric tons	1,026	1,186	1,281	1,366 [r]	1,422
Coal, bituminous		79,210	54,610	65,041	74,800	17,940
Copper, contained in concentrates and doré		4,222	3,715	4,240	3,462	3,284
Diamond[3]	carats	239,761	236,582	303,920	219,600	272,200
Gemstones, excluding diamond:[4]						
Amethyst[e]	kilograms	270	270	270	270 [r]	270
Aquamarine[e]	do.	600	278 [5]	280 [r]	280 [r]	280
Cordierite (iolite)[e]	do.	310	310	310 [r]	310 [r]	310
Garnet	do.	13,000 [e]	5,911	5,900 [r,e]	5,900 [r,e]	5,900 [e]
Ruby	do.	1,800 [e]	2,675	2,700 [r,e]	2,700 [r,e]	2,700 [e]
Sapphire	do.	2,400 [e]	1,338	1,300 [r,e]	1,300 [r,e]	1,300 [e]
Tanzanite	do.	6,461	4,490	3,400 [r,e]	3,400 [r,e]	3,400
Other[e]	do.	171,000	1,520,000	1,600,000	614,000 [r]	2,480,000
Total	do.	196,000	1,540,000	1,610,000	628,000 [r]	2,490,000
Gold	do.	43,320	48,018	48,178	52,236	47,000
Gypsum and anhydrite, crude		73,000	33,232	59,231	23,100	32,600
Lime		--	--	20,000	20,000	20,000
Natural gas	million cubic meters	--	--	119	408	510 [e]
Phosphate minerals:						
Apatite		1,182	3,738	6,570	7,096	2,881
P_2O_5 content		350	1,100	1,300 [r]	1,300	580
Salt, all types		71,200	58,978	57,062	51,200 [r]	34,800
Silver, contained in concentrates and doré	kilograms	7,669	7,986	13,216	12,891	14,906
Steel, semimanufactured		25,418	38,794	40,029	47,652	55,212
Stone, sand, and gravel:						
Aggregates		20,223	107,960	120,000 [e]	140,000 [e]	140,000 [e]
Dolomite		NA	2,197	2,500 [e]	2,900 [e]	2,900 [e]
Limestone, crushed		2,856,711	1,206,000	1,390,900	2,006,400 [r]	1,607,600
Pozzolanic materials		52,000	24,460 [r]	152,679	163,499	129,295
Sand		503,485	2,035,960	2,400,000 [e]	2,800,000 [e]	2,800,000 [e]

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. NA Not available. -- Zero.

[1]Table includes data available through October 24, 2007.

[2]In addition to the commodities listed, modest quantities of crude construction materials, including brick clay, are produced, but available information is inadequate to make estimates of output.

[3]Diamond figures are estimated to represent 85% gem-quality or semigem-quality and 15% industrial-quality stones. Does not include smuggled artisanal production.

[4]Other precious and semiprecious stones produced include alexandrite, chrysoprase, emerald, kyanite, moonstone, opal, peridot, quartz, spinel, and tourmaline. Does not include smuggled artisanal production.

[5]Reported figure.

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TABLE 2
TANZANIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity
Cement		Tanzania Portland Cement Company Ltd. (HeidelbergCement AG, 69.3%)	Plant at Wazo Hill	670,000.
Do.		Tanga Cement Company Ltd. (Holcim South Africa (Pty) Ltd., 62.5%)	Plant at Tanga	500,000.
Do.		Mbeya Cement Company Ltd. (LaFarge Group, 58%)	Plant at Mbeya	300,000.
Coal, bituminous		Kiwira Coal and Power Ltd. (Tanpower Resources Ltd., 85%, and Government, 15%)	Kiwira Mine	150,000 run of mine; 93,000 washed.
Copper, in concentrates and doré		Bulyanhulu Gold Mine Ltd. (Barrick Gold Corp., 100%)	Bulyanhulu Mine near Kahama	6,300.
Diamond		Williamson Diamonds Ltd. (DeBeers Group, 75%, and Government, 25%)	Williamson Mine near Shinyanga	4,000,000 ore processing.
Do.	carats	do.	do.	260,000 diamond.
Do.	do.	El Hillal Minerals Ltd.	Near Williamson Mine	24,000.[e]
Glass		Kioo Ltd.	Dar es Salaam	36,000.
Gold		Geita Gold Mining Ltd. (AngloGold Ashanti Ltd., 100%)	Geita Mine near Nyakabale	6,000,000 ore processing.
Do.	kilograms	do.	do.	19,800 gold.
Do.		Bulyanhulu Gold Mine Ltd.	Bulyanhulu Mine near Kahama	1,100,000 ore processing.
Do.	kilograms	do.	do.	12,600 gold.
Do.		North Mara Gold Mine Ltd. (Barrick Gold Corp., 100%)	North Mara Mine in Tarime District	2,900,000 ore processing.
Do.	kilograms	do.	do.	9,300 gold.
Do.		Resolute Mining Ltd.	Golden Pride Mine near Isanga	3,000,000 ore processing.
Do.	kilograms	do.	do.	4,800 gold.
Do.		Pangea Minerals Ltd. (Barrick Gold Corp., 70%, and Explorations Minières du Nord Ltée, 30%)	Tulawaka Mine	365,000 ore processing.
Do.	kilograms	do.	do.	4,000 gold.
Do.		Time Mining Operations (subsidiary of Time Mining Group)	Buhemba Mine, 47 kilometers southeast of Musoma	1,300,000 ore processing.
Do.	kilograms	do.	do.	2,600 gold.
Lime		Athi River Mining Ltd.	Plant at Tanga	40,000.
Natural gas	million cubic meters	Orca Exploration Group Inc.	Gasfield on Songo Songo Island	720.
Do.	do.	Artumas Energy (Tanzania) Ltd. (subsidiary of Artumas Group Inc.)	Gasfield at Mnazi Bay	100.
Petroleum products[1]	thousand 42-gallon barrels	Tanzanian and Italian Petroleum Refining Co. Ltd.	Refinery at Dar es Salaam	5,440.
Phosphate rock		Minjingu Mines and Fertlizers Ltd.	Mine at Minjingu	30,000.
Salt		Nyanza Mines (Tanganyika) Ltd.	Nyanza Mines at Uvinza	60,000.
Silver	kilograms	Bulyanhulu Gold Mine Ltd.	Bulyanhulu Mine near Kahama	9,200.
Steel		Aluminum Africa Ltd.	Plant at Dar es Salaam	45,000.[e]
Do.		SITA Rollings Ltd.	do.	14,000 rolled.
Do.		MM Integrated Steel Mills Ltd.	do.	2,000 rolled.
Do.		Aluminum Africa Ltd.	do.	40,000 galvanized.
Do.		MM Integrated Steel Mills Ltd.	do.	36,000 galvanized.
Tanzanite		TanzaniteOne Ltd.	Mine at Merelani, Block C[2]	120,000 ore processing.
Do.	kilograms	do.	do.	1,600 tanzanite.
Do.	do.	Tanzanite Africa Ltd. (IPP Media Ltd.)	Mine at Merelani, Block D Extension	NA.
Do.	do.	Kilimanjaro Mines Ltd.	Mine at Merelani, Block A	NA.
Do.	do.	Small-scale and artisanal miners	Mines at Merelani, Blocks B and D	NA.

[e]Estimated; estimated data are rounded to no more than three significant digits. NA Not available.
[1]Shut down in 2000.
[2]Formerly the graphite processing plant at Merelani operated by Phoenix Minerals Ltd.

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TABLE 3
TANZANIA: GOLD RESOURCES AND RESERVES IN 2006

Project	Major operating companies	Tonnage (million metric tons)	Grade (grams per metric ton)	Contained gold (metric tons)
Reserves:				
Bulyanhulu[1]	Bulyanhulu Gold Mine Ltd. (Barrick Gold Corp., 100%)	30.5	11.4	348
Geita[2]	Geita Gold Mining Ltd. (AngloGold Ashanti Ltd., 100%)	79.0	3.3	264
North Mara[1]	North Mara Gold Mine Ltd. (Barrick Gold Corp., 100%)	31.8	3.2	102
Buzwagi[1, 3]	Barrick Gold Corp.	45.2	1.8	82
Golden Pride[2]	Resolute Mining Ltd.	25.2	1.6	39
Tulawaka[1]	Pangea Minerals Ltd. (Barrick Gold Corp., 70%, and Exploration Minières du Nord Ltée, 30%)	1.3	11.1	15
Total		213.0	4.7	850
Resources:				
Bulyanhulu	Bulyanhulu Gold Mine Ltd.	39.0	12.3 [4]	481
Geita	Geita Gold Mines	142.5	3.2	458
Tusker	Barrick Gold Corp., 51%, and Sub-Sahara Resources NL, 49%	123.3	1.2	142
North Mara	North Mara Gold Mine Ltd.	40.2	3.1	124
Buzwagi[3]	Barrick Gold Corp.	53.5	1.8 [4]	97
Buckreef/Rwamagaza:	IAMGOLD Corp.	27.2	2.2	61
Golden Pride	Resolute Mining Ltd.	38.6	1.5	57
Golden Ridge	Kahama Mining Corp. Ltd.	33.1	1.5	46
Nyakafuru	do.	19.4	1.7	33
Buhemba	Time Mining Group	11.4	2.0	23
Mgusu	Shanta Gold Ltd.	6.2	3.7	23
Tulawaka	Pangea Minerals Ltd.	1.8	11.1	20
Kitongo:				
Main Zone	IAMGOLD Corp.	10.5	1.3	14
Isegenghe Hill	do.	0.2	14.4	2
Miyabi	African Eagle Resources plc	12.4	1.3	16
Ikungu	Lakota Resources Inc.	2.5	2.3	6
Total		523	3.6	1,600

[1]Definitions of resources and reserves are based on National Instrument 43-101, as required by Canadian securities regulatory authorities.
[2]Definitions of resources and reserves are based on the Australasian Code for the Reporting of Identified Mineral Resources and Ore Reserves issued by the Joint Committee for the Australasian Institute of Geoscientists and the Australian Mining Industry Council.
[3]Formerly known as Chocolate Reef.
[4]Note that, in most cases, the grade of resources is lower than the grade for reserves, but in this case, the grade of the less economic material is higher, leading to the paradox of a higher resource grade.

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THE MINERAL INDUSTRY OF TUNISIA

By Philip M. Mobbs

Phosphate rock and phosphate-based fertilizers were Tunisia's major contributions to the international mineral supply. Tunisia was the world's fifth ranked phosphate rock producer and accounted for more than 5% of the world supply of phosphate rock. About 80% of Tunisian phosphate rock production was processed locally into fertilizers, such as diammonium phosphate and triple superphosphate, and phosphoric acid. Tunisia was a minor producer of petroleum and ranked 11th among African producers of crude oil (BP p.l.c., 2007, p. 8; Jasinski, 2007).

Despite the drop in the production of crude oil and natural gas in 2006, the hydrocarbon sector accounted for about 4.7% of Tunisia's gross domestic product (GDP) compared with 4.3% in 2005. Increased international petroleum prices, which more than offset the negative economic impact of the production volume decline, accounted for the increase in value of Tunisian hydrocarbon production. The cement, construction materials, glass, mining, and phosphate-based fertilizer sectors accounted for about 4% of the GDP (Central Bank of Tunisia, 2007, p. 54).

Crude and refined petroleum accounted for about 13% of total exports. Minerals and mineral-based products, such as cement, fertilizer, raw steel, and manufactured steel pipes, accounted for about 9% of total exports (Central Bank of Tunisia, 2007, p. 102, 107, 109, 113, 117).

Mineral exploration and production were licensed by the Government according to the Mining Code (law No. 2003-30 of April 28, 2003). The Hydrocarbon Code (law No. 99-93 of August 17, 1999) and amendments (which included law No. 2002-23 of February 14, 2002, and law No. 2004-61 of July 27, 2004) regulated natural gas and oil operations.

Production

The Tunisian mineral sector posted mixed results in 2006. Production of most mineral and mineral-based commodities fell within a range of plus or minus 7% of that of 2005. Production of lead and zinc ore ceased in 2005.

Structure of the Mineral Industry

The fertilizer, iron and steel, phosphate, and petroleum refining sectors of the mineral industry were controlled by state-owned companies. Much of the cement sector had been privatized in the past 10 years. Private companies produced crude construction materials. The Government promoted programs to enhance the ability of small- and medium-sized industrial businesses to compete with international companies.

Enterprises Tunisienne d'Activités Petrolières (ETAP), which participated in production joint ventures with international oil companies or monitored their exploration and production operations, managed the Government's interest in the petroleum sector. There were 38 gasfields and oilfields, but most of the country's petroleum output was produced from the Adam, the Ashtart, the Dalia, the Didon, El Borma, the Haja, the Miskar, and the Oudna Fields. Société Tunisienne des Industries du Raffinage operated the country's petroleum refinery.

Commodity Review

Metals

Iron and Steel.—Société Tunisienne de Sidérurgie proposed to install an additional electric arc furnace (EAF) at its El Fouladh facility. After the scheduled installation and startup of the new 100,000 metric-ton-per-year (t/yr)-capacity EAF in 2008, the company planned to expand the capacity of its operating 65,000-t/yr-capacity EAF to 100,000 t/yr of crude steel. The combined 200,000 t/yr capacity of the two EAFs would match the company's rolling mill capacity, which would eliminate the need to import billet for the mill (Metal Bulletin, 2007).

Lead and Zinc.—In 2006, Albidon Ltd. of Australia, Breakwater Resources Ltd. of Canada, and Maghreb Minerals Plc of the United Kingdom continued exploration for economic lead and zinc deposits. An Albidon and Zinifex Ltd. of Australia joint venture and Maghreb Minerals were expected to increase exploration activity in 2007.

Industrial Minerals

Cement.—Groupo Prasa of Spain proposed an expansion program that would increase the white cement production capacity of Société Tuniso-Andalouse de Ciment Blanc S.A. (Sotacib) (formerly Société Tuniso-Algérienne de Ciment Blanc S.A.) to 500,000 t/yr from a nominal design capacity of 260,000 t/yr. In recent years, Sotacib routinely produced more than the plant's design capacity, averaging about 300,000 t/yr of white cement (Middle East Economic Digest, 2006c).

Nitrogen, Phosphate Rock, and Sulfur.—Group Chimique Tunisienne (GCT) initiated an evaluation of the construction of a 2,200-metric-ton-per-day (t/d)-capacity ammonia plant and a 1,000- to 3,000-t/d-capacity urea plant. GCT, in conjunction with the Indian firms of Coromandel Fertilisers Ltd. and Gujarat State Fertilizers & Chemicals Ltd., proposed to build a 3,600-t/d-capacity sulfuric acid plant and 1,100-t/d-capacity phosphoric acid plant near the existing GCT facility at Skhira. If approved, the Skhira 2 project could begin initial production in 2010 (Middle East Economic Digest, 2006a, b).

Envisan N.V., which was a subsidiary of Jan de Nul N.V. of Belgium, and state-owned Société Générale d'Entreprise de Matériel et de Travaux started the decontamination and rehabilitation of the fertilizer sector's phosphoric gypsum waste dump in the Taparura area of Sfax. The rehabilitation project was expected to take 30 months.

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Mineral Fuels

Petroleum.—The Adam concession, which included the Adam, the Hawa, and the Dalia Fields, remained Tunisia's leading crude oil producing center and posted a 4.2% increase in production in 2006 compared with that of 2005. Crude oil production from El Borma Field declined by 9.8% compared with that of 2005, and production from the Ashtart Field declined by 16.2% in 2006 compared with that of 2005. New production included that from the Oudna Field, which was operated by Lundin Petroleum AB of Sweden for joint-venture partners Atlantis Tunisia Ltd. and ETAP. Lundin had ended production from the Isis Field in April in order to rehabilitate the Ikdam floating production, storage, and offloading vessel (which had handled the production from the Isis Field) for use at Oudna (Central Bank of Tunisia, 2007, p. 57).

Outlook

The mineral and energy sectors, which accounted for about 22% of total Tunisian exports, are integral parts of Tunisia's economic future. Metal deposits in northern Tunisia are expected to continue to attract exploration interest. The phosphate mines of Compagnie des Phosphates de Gafsa are expected to be able to respond to increased demand for washed phosphate rock. With high international petroleum prices, the hydrocarbon resources of Tunisia, which are small relative to the other oil-producing nations of North Africa, are expected to continue to attract international oil companies.

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TABLE I
TUNISIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004	2005	2006[p]
METALS						
Iron and steel:						
Iron ore:						
Direct shipping ore and concentrate, gross weight		198	164	256	206	214
Fe content		105	97	134	108	112
Metal:						
Pig iron		152	36	--	--	--
Steel, crude		200	86	70	66	68
Lead, mine output, Pb content	metric tons	5,081	5,000	5,470	8,708	--
Silver, metal, primary[e]	kilograms	3,000	3,000	2,400	1,200	--
Zinc:						
Concentrate, gross weight	metric tons	64,890	65,800	52,747	29,412	--
Zn content	do.	35,692	36,000	29,011	15,889	--
INDUSTRIAL MINERALS						
Barite	metric tons	5,539	3,000	1,813	--	--
Cement, hydraulic[3]		6,022	6,038	6,662	6,691	6,932
Clays, for construction and clay products		4,400	4,500	5,200	5,400	5,600
Fertilizers:						
Triple superphosphate		796	875	868	848	792
Phosphoric acid		1,219	1,164	1,241	1,217	1,181
Diammonium phosphate		1,315	1,324	1,314 [r]	1,115 [r]	1,093
Ammonium nitrate		127	164	134	149 [r]	151
Fluorine, aluminum fluoride		39	45	42	42	43
Gypsum[e, 4]		125	110	108	113	120
Lime		471	446	476	424	401
Phosphate rock, washed, gross weight		7,461	7,890	8,051	8,220	7,801
Salt, marine		616	700	1,117	1,132	1,127
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross	million cubic meters	2,149	2,167	2,298 [r]	2,343 [r]	2,149
Dry[e]	do.	1,700	1,750	1,850 [r]	1,900 [r]	1,750
Petroleum:						
Crude	thousand 42-gallon barrels	26,800	24,300	25,700	26,200	25,000
Refinery products:						
Liquefied petroleum gas	do.	1,310	1,200	1,250	1,260	1,280
Gasoline	do.	3,380	3,600	3,450	1,840 [r]	1,540
Kerosene	do.	1,590	1,270	1,310	1,770	1,050
Distillate fuel oil	do.	3,500	3,780	3,220	3,600 [r]	3,780
Residual fuel oil	do.	4,020	4,050	3,960	4,060 [r]	4,020
Other[e]	do.	1,120	1,180	660	1,300	1,390
Total[e]	do.	14,900	15,100	13,900	13,800 [r]	13,100

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [p]Preliminary. [r]Revised. -- Zero.

[1]Table includes data available through September 24, 2007.

[2]In addition to the commodities listed, a variety of crude construction materials (sand and gravel and stone) was produced, but output was not reported, and available information was inadequate to make estimates of output.

[3]Includes white cement production, in thousand metric tons: 2002--259; 2003--296; 2004--304; 2005--333; and 2006--333.

[4]Does not include phosphatic gypsum (waste product) generated during fertilizer production.

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TABLE 2
TUNISIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity[1]
Aluminum fluoride	Industries Chimiques du Fluor	Ghannouch, near Gabes	43
Cement:			
Portland	Société des Ciment d'Enfidha (Corporación Uniland, S.A., 88%)	Enfidha	2,000
Do.	Société des Ciment de Jbel Oust (Cimentos de Portugal SGPS, S.A., 100%)	Jbel Oust	1,600
Do.	Société des Ciment de Gabès (Secil - Companhia Geral de Cal e Cimento, S.A., 99%)	Gabes	1,100
Do.	Société des Ciment d'Oum el Kélil (Government, 100%)	Le Kef	970
Do.	Société des Ciment de Bizerte (Government, 100%)	Bizerte	840
Do.	Société des Ciments Artificiels Tunisiens (Colacem S.p.A., 100%)	Ben Arous	800
White	Société Tuniso-Andalouse de Ciment Blanc S.A. (Grupo Prasa, 100%)	Feriana	333 [2]
Fertilizer:			
Ammonium nitrate	Group Chimique Tunisienne (Government, 100%)	Ghannouch, near Gabes	330 [3]
Diammonium phosphate	do.	do.	1,300
Triple superphosphate	do.	M'Dhilla	465
Do.	do.	Sfax	330
Gypsum	Les Plâtres Tunisiens (Knauf Gips KG of Germany)	Maknassy	100
Iron and steel:			
Iron ore	Société de Djebel Djerissa (Government, 100%)	Djerissa Mine	175
Do.	do.	Tamera Mine	75
Steel, crude	Société Tunisienne de Sidérurgie (Government, 100%)	El Fouladh	65
Steel, rolled, bar and rod	Intermetal S.A. (Private, 100%)	Ben Arous	300
Petroleum, refined 42-gallon barrels per day	Société Tunisienne des Industries du Raffinage (Government, 100%)	Bizerte	34,000
Phosphate rock	Compagnie des Phosphates de Gafsa (Government, 100%)	Kef Eddour Mine	3,200
Do.	do.	Kef Eschfair Mine	3,000
Do.	do.	Jallabia Mining Center	1,700
Do.	do.	Redeyef Mine	150
Phosphoric acid	Group Chimique Tunisienne (Government, 100%)	Ghannouch, near Gabes	470
Do.	do.	Skhira	375
Do.	do.	M'Dhilla	183
Do.	do.	Sfax	131
Salt	Compagnie Générale des Salines de Tunisie	Sfax and Zarzis	760
Do.	SAIDA S.A.	Sebkhet Sidi El Heni	250

[1]Actual production may significantly exceed nominal capacity.
[2]Nominal capacity is 260,000 metric tons per year (t/yr).
[3]Does not include production capacity of 30,000 t/yr of explosives-grade ammonium nitrate.

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THE MINERAL INDUSTRY OF UGANDA

Harold R. Newman

The East African country of Uganda was succeeding in attracting local and foreign investment interest in its mineral sector. To enhance the positive trend, the Government launched a project to improve geophysical survey capabilities and other Government services related to the mineral sector. The Government secured a $7.8 million grant from the African Development Fund to finance this project. The grant was to be used to finance airborne geophysical surveys, which would include acquisition of airborne data, compilation of information on surface and subsurface geology, processing and interpretation of the data, quality control, and publication of the data. The grant monies would also be used to procure equipment needed to provide support services for mineral exploration and exploitation programs and to set up a rock sample laboratory and museum (Afrol News, 2006)

Minerals in the National Economy

Uganda produced cobalt, gold, iron ore, niobium (columbium), steel, tantalum, tin, and tungsten. The country also produced such industrial minerals as gypsum, kaolin and other clays, lime, salt, soapstone, and vermiculite, and such building materials as cement, limestone, and pozzolanic materials. Despite Uganda's long history of mineral production, however, many areas of the country that were thought to be highly prospective for minerals have received little or no exploration. The Kamwenge District has one of the richest mineral deposits in the country, including deposits of gold, lead, and limestone deposits, especially in the area around Kitata.

The mining and quarrying sector grew by 8.3% in fiscal year 2005-06 compared with 11.6% in fiscal year 2004-05. The change was attributable to decreased demand and decreased exports (Bank of Uganda, 2006, p. 46).

Production

Most of Uganda's aggregate, cobalt, columbite-tantalite, gold, and vermiculite production was exported; production of these commodities was dependant upon world market conditions. For cement, limestone, and pozzolanic materials, production and consumption depended primarily on the domestic construction sector. Data on mineral production are provided in table 1.

Structure of the Mineral Industry

Table 2 is a list of the major mineral industry facilities in Uganda. The table also provides the location and production capacities of these facilities.

Commodity Review

Metals

Cobalt and Copper.—Blue Earth Refineries Ltd. through its subsidiary Kasese Cobalt Company Ltd. engaged in cobalt refining in Uganda. The company operated a 1,000-metric-ton-per-year (t/yr) processing plant that recovered the cobalt contained in a pyrite stockpile from the former Kilembe copper mine.

Blue Earth planned to produce 720 t/yr of cobalt at a recovery rate of 70%. The metal refining operations included the bioleaching of the pyrite concentrate, solvent extraction of the dissolved cobalt, and recovery through electrowinning. The stockpile was expected to last for 7 years (Business Week, 2006).

Gold.—International Business Investments Corp. (IBI) announced the resumption of its gold exploration program. The program would be a key component of IBI's exploration and development program, which would concentrate on high-value mineral resources in Uganda. The gold exploration program would be conducted at the same time and along with the Ugandan Government's geophysical aerial surveys of highly prospective mineral targets (International Business Investments Corp., 2006).

Iron and Steel.—Sembule Steel Mills Ltd. was a leader in the construction steel industry. It manufactured and supplied wire and roofing products to customers in more than 10 countries in East and Central Africa. The wire division manufactured products derived from coils of steel wire, and the roofing division manufactured reinforcement, roofing, and walling products derived from coils of steel sheet. The steel rolling mill manufactured iron bars and coils used in the other two divisions (Sembule Steel Mills Ltd., 2006).

Tantalum.—Uganda Gold Mining Ltd. owned the Nyanga tantalite property in western Uganda. Columbite/tantalite mineralization was found in the form of lenses located adjacent to and on both sides of a 16-meter (m)-wide near-vertical quartz vein exposed on the surface for 50 m and open on strike. Samples were taken from one of the lenses and shipped to a smelter where a return in excess of 25% tantalum was reported. The next phase of exploration was to include underground development to determine the character of the mineralization (MBendi Information Services (Pty) Ltd., 2006).

Industrial Minerals

Clay and Shale.—Clay deposits suitable for the manufacture of bricks, pottery, and tiles are widely distributed throughout Uganda. Ball clay was mined at Mukono, and brick clay was mined at Kajansi. Muhindo Enterprises Ltd. was issued a license to mine and process kaolin at the Mutaka deposit, which was estimated to contain about 3 million metric tons (Mt) of 65%

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kaolin material. The Mutaka project is located in the Bushenyi District (Muhindo Enterprises Ltd., 2006).

Stone, Crushed and Dimension.—Stone suitable for crushing was available in most parts of the country. Gneiss, granite, quartzite, and sandstone were widely distributed throughout areas of Precambrian basement. Agglomerates and volcanic lavas occur in the east and southeast areas of the country. Marble occurs extensively in the Moroto District.

The major limestone deposits at Hima and Tororo continued to provide the major raw materials for Uganda's cement industry. Limestone was quarried by Hima Cement Ltd., Kilembe Mines Ltd., and Tororo Cement Industry Ltd. The production of limestone increased to an estimated 600,000 metric tons (t) in 2006 from 540,756 t in 2005, and the production of pozzolanic materials increased to an estimated 140,000 t in 2006 from 138,933 t in 2005.

Vermiculite.—IBI announced that it had signed an agreement with Rio Tinto Uganda (a subsidiary of Rio Tinto plc of the United Kingdom) for the sale of IBI's Namekara vermiculite mine. The Namekara deposit is located on the southern ring of the 13-kilometer-diameter Bukusu carbonate complex in the Mbale District of southeast Uganda, close to the Kenya border. Reserves were estimated to be about 5 Mt, which would be sufficient to support more than 100 years of production. Rio Tinto agreed to pay IBI $5 million for the project, as well as ongoing royalties (Mining Weekly, 2007).

Mineral Fuels and Other Sources of Energy

Petroleum.—In November 2006, Tullow announced that its Kingfisher-1 well had produced a stabilized flow rate of 4,120 barrels per day of oil in the upper zone. Tullow decided to sidestep the well and proceed with drilling to deeper primary objectives (Tullow Oil plc, 2006).

Renewable Energy.—A Government study stated that Uganda had a potential generation capacity of 1,250 megawatts (MW) of electricity from renewable energy sources, of which the potential capacity from geothermal sources was 450 MW, and peat resources, 800 MW; this new capacity would more than offset the country's 260-MW power deficit. The country was facing a power crisis, which had led to power rationing. The installed hydropower capacity at the Kiira and the Nalubaale power stations was 380 MW; only 1.05 terawatt hours (TWh) was generated in 2006. Thermal-generated power in 2006 totaled 0.74 TWh. This deficit forced the Government to rely on other power sources (Alexander's Gas & Oil Connections, 2006).

Outlook

The Uganda Ministry of Energy and Mineral Development predicted that Uganda's gross domestic product would grow by 6.2% in 2006 and 6.1% in 2007. Most of Uganda's cobalt, columbite-tantalite, gold, and vermiculite production will continue to be exported; the outlook for these commodities depends heavily upon world market conditions. For cement, limestone, and pozzolanic materials, the outlook depends primarily upon the strength of the domestic construction sector. The aid provided to Uganda by the African Development Fund, the Nordic Development Fund, and the World Bank Group under the Sustainable Management of Mineral Resources Project could assist the country in increasing production and tax revenues from its mining sector. The continued unreliability of power supplies is expected to pose difficulties for mining and mineral processing operations (Uganda Ministry of Energy and Mineral Development, 2006).

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TABLE 1

UGANDA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004	2005	2006[e]
Beryllium, mine output, Be content		NA	-- [3]	25	2	--
Cement, hydraulic		505,959	507,068	558,988	630,000 [e]	630,000
Clay:						
Kaolin		178	--	537	55	25
Other		44,790	44,000 [e]	44,000 [e]	51,000 [e]	50,000
Cobalt, refined		450 [e]	--	436	638	689 [3]
Gold, mine output, Au content[4]	kilograms	3	40	1,447	46	22 [3]
Gypsum		5	43	181	285	121 [3]
Iron ore		--	--	--	209	100
Lime, hydrated and quick[e]		10,000	10,000	10,000	10,000	10,000
Limestone		140,022	226,408	228,776	540,756	425,610 [3]
Niobium (columbium) and tantalum, ore and concentrate:						
Gross weight	kilograms	6,463	6,240	376	273	275
Nb content	do.	3,036	3,000	170 [e]	130 [e]	130
Ta content	do.	1,736	1,700	100 [e]	70 [e]	70
Pozzolanic materials		12,388	65,587	134,644	138,933	213,639 [3]
Salt[e]		5,000	5,000	5,000	1,500	1,500
Steel, semimanufactured[e]		7,000	7,000	7,000	-- [r]	--
Tin, mine output, Sn content		--	1	2	--	--
Tungsten, mine output, W content		16	1	52	45 [r]	95 [3]
Vermiculite		664	1,724	2,688	2,574	2,600

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised. NA Not available. -- Zero.

[1]Includes data available through October 31, 2007.

[2]In addition to the commodities listed, the following are presumably produced but information is inadequate to estimate output: corundum, lead, marble, sand and gravel, silica sand, and soapstone.

[3]Reported number.

[4]Does not include smuggled artisanal production.

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TABLE 2
UGANDA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity	Major operating companies	Location of main facilities	Annual capacity
Cement	Tororo Cement Industries Ltd.	Tororo	394,000
Do.	Hima Cement Industries Ltd. (Bamburi Cement Ltd., 70%)	Kasese	350,000
Cobalt, refined	Kasese Cobalt Company Ltd. (Blue Earth Refineries Ltd., 75%, and Government, 25%)	do.	1,000
Gold kilograms	M/S Busitema Mining Company Ltd.	Tiira Mine near Busia	400
Lead, refined secondary	Uganda Batteries Ltd.	Kampala	1,000
Niobium (columbium) and tantalum	M/S Technical Support and Services Ltd.	Wampewo	11,000 e
Soapstone	African Minerals Ltd.	Moroto	NA
Steel:[1]			
Crude[2]	Steel Corp. of East Africa Ltd. (subsidiary of Madhvani Group)	Jinja	25,000
Do.	Steel Rolling Mills Ltd. (subsidiary of Alam Group Ltd.)	do.	21,000
Billet[2]	Steel Corp. of East Africa Ltd. (subsidiary of Madhvani Group)	do.	60,000
Rolled	do.	do.	101,200
Do.[2]	Steel Rolling Mills Ltd. (subsidiary of Alam Group Ltd.)	do.	40,000
Do.[2]	BM Technical Services Ltd.	Mbarara	20,000
Do.	Sembule Steel Mills Ltd.	Kampala	20,000
Stone, crushed	Hima Cement Industries Ltd.	Kasese District	NA
Do.	Kilembe Mines Ltd.	do.	NA
Do.	Tororo Cement Industries Ltd.	Tororo District	NA
Do.	Zzimwe Construction Ltd.	Mukono District	690,000
Tungsten[2]	Krone Uganda Ltd.	Nyamurilo	115
Vermiculite	Canmin Resources Ltd. (subsidiary of International Business Investments Corp.)	Namekara	25,000

eEstimated. NA Not available.

[1]In addition to its crude, billet, and rolled steel facilities, Uganda has a galvanized steel plant with a capacity of 30,000 metric tons per year.

[2]Not operating in 2005 and 2006.

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THE MINERAL INDUSTRY OF ZAMBIA

By Philip M. Mobbs

Zambia was a significant producer of cobalt, copper, and gem-quality emerald. The country's mines accounted for about 12% of total world cobalt production and 3% of copper production. Coal, a variety of mineral commodities for the construction industry, other semiprecious gemstones, gold, lime, refined petroleum, silver, and sulfur also were produced in Zambia. Zambia has no natural gas or crude oil production, and was dependent primarily on hydroelectric-generated electricity for most of the country's nontransportation power needs (Edelstein, 2008; Shedd, 2008).

The mining sector was regulated by the Mines and Mineral Act of 1995 and amendments. In 2006, the Zambia Development Agency Act was promulgated to encourage national economic growth and development by the promotion of trade and investment. Investment in most types of mineral operations were covered by the Zambia Development Agency Act, although minerals produced for the construction industry, such as clay, sand, and most types of stone, were excluded.

Minerals in the National Economy

Copper and cobalt exports were valued at about $4 billion in 2006, and accounted for more than 70% of Zambia's merchandise exports. In 2006, the value of cobalt and copper exports tripled compared with that recorded in 2005. The increased value was attributed to the increase in international metal prices (Bank of Zambia, 2007, p. 8).

Production

Cement production and limestone mined for cement were estimated to have increased by about 50% and 60%, respectively, in 2006; copper ore, by about 15%; and refined copper, by 15%. An approximately 14% decline was posted for cobalt production. Estimated coal production declined by almost 60%. Data on mineral production are provided in table 1.

Structure of the Mineral Industry

The mining sector was administered by the Geological Survey Department, the Mines Development Department, and the Mines Safety Department of the Ministry of Mines and Minerals Development. The Ministry of Commerce, Trade and Industry oversaw the industrial manufacturing sector.

Most of the assets of the former Government-controlled mining company had been privatized in past years. The Government retained minority interest in most of the large copper projects through its Zambia Consolidated Copper Mines Investments Holdings Plc. Data on the capacity and ownership of selected mineral operations are provided in table 2.

Commodity Review

The worldwide rise in the price of minerals has increased investor interest in undeveloped mineral resources in Zambia. A number of exploration projects for metals, which included cobalt, copper, gold, and manganese; industrial minerals, which included diamond and semiprecious gemstones; and mineral fuels and related materials, which included uranium, were underway in 2006. Companies with exploration projects in Zambia included African Eagle Resources plc of the United Kingdom on the Mkushi copper prospect; AIM Resources Ltd. of Australia on the Mumbwa copper and gold project; Albidon Ltd. of Australia on the Munali nickel and the Zimba copper, nickel, and platinum-group metals prospects; and the joint venture of Albidon and African Energy Resources Pty. Ltd. on the Chirundu and the Kariba Valley uranium projects. Caledonia Mining Corp. of Canada continued its evaluation of the Nama cobalt project.

Equinox Minerals Ltd. of Australia continued its development of Lumwana copper prospect. Concerns about the infrastructure in northwestern Zambia had long delayed the development of the prospect. The Government had recently completed the installation of a 330-kilovolt power line to Solwezi, which was to be extended to the Lumwana Mine site by 2007, and the Government planned to upgrade the highway that passed close by the mine site. Equinox planned to start mining operations at Lumwana in 2008.

Other exploration activity included Luiri Gold Ltd. of Canada on the Dunrobin and the Matala Dome gold prospects, Mayfair Mining & Minerals Ltd. of Zambia on the Funzwe River and the Nansenga Stream gold licenses, OmegaCorp Ltd. of Australia on the Kariba uranium project, and Red Rock Resources plc of the United Kingdom on the Chiwefwe manganese prospect. The Canadian dredging company Spirit of the River evaluated diamond occurrences along the Barotse River in western Zambia. Zambezi Nickel Ltd., which was a subsidiary of Zambezi Resources Ltd. of Bermuda, drilled the Mitaba West nickel prospect, and Zambezi Resources explored the Cheowa copper, the Chalwenga gold, the Chumbwe gold, the Kangaluwi gold, and the Nkala and the Oryx uranium prospects.

Metals

Copper.—In 2006, First Quantum Minerals Ltd. of Canada completed an expansion of its sulfide ore treatment capacity at the Kansanshi Mine to 8 million metric tons per year (Mt/yr). The Kansanshi Mine was also able to process 4 Mt/yr of oxide ore. By 2008, First Quantum planned to expand the mine's sulfide ore treatment capacity to 12 Mt/yr. First Quantum also completed construction of a high-pressure leach (HPL) facility at Kansanshi. The HPL facility included two 52,500-metric-ton-per-year (t/yr)-capacity autoclaves, which were to process concentrated sulfide ore, and a 35,000-t/yr-capacity solvent

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extraction-electrowinning plant, which would produce copper cathode (First Quantum Minerals Ltd., 2007a, p. 15, 17; 2007b, p. 7).

Mopani Copper Mines plc completed the construction of an ISASMELT smelter at Mufulira; the smelter had an initial nominal copper concentrate processing capacity of 720,000 t/yr. The new smelter replaced an electric arc furnace facility that had a processing capacity of about 420,000 t/yr. Commissioning of the ISASMELT smelter, which was designed to be expandable to process 850,000 t/yr of copper concentrate, was underway at yearend (First Quantum Minerals Ltd., 2007a, p. 29).

In 2006, production of milled ore at the Chibuluma South Mine reached the plant's 40,000-metric-ton-per-month (t/mo) design capacity. Metorex Ltd. of South Africa began an evaluation of the expansion of the plant's capacity to 50,000 t/mo. Metorex also recommissioned the Sable processing complex at Kabwe; the old Sable Zinc plant had been converted to process copper concentrate imported from Congo (Kinshasa) (Metorex Ltd., 2006, p. 6).

In 2006, Sino-Metals Leach Zambia Ltd. started copper cathode production. Sino-Metals processed tailings from the Chambishi Mine and other locally produced oxide ore, and expected to ramp up operations to the plant's 8,000-t/yr design capacity in 2007 (Kordosky, 2007, p. 50).

Zinc.—In 2006, Metorex continued its evaluation of the possibility of producing zinc metal from the zinc oxide and sulfide dumps at Kabwe. Metorex began the construction of a 5,000-t/yr-capacity zinc leach and electrowinning plant at its Sable processing complex; the plant was expected to begin operations in 2007 (Metorex Ltd., 2007).

Industrial Minerals

Gemstones.—Gemfields Resources PLC of the United Kingdom initiated mine development of the Mbuva-Chibolele emerald mine at the beginning of the year and began trial mining in July 2006. Mayfair Mining & Minerals, Inc. of the United States and local partners were developing an amethyst mining operation in the Mapatizya area, near the Kariba amethyst mine of Kariba Minerals Inc.

Outlook

Zambia has many deposits and occurrences of metals; the mining industry, however, historically has been dominated by the copper sector. The surge in international mineral prices during the past few years has increased investor interest in ascertaining the economic potential of deposits of metals, such as gold, nickel, and zinc; industrial minerals and commodities, especially semiprecious gemstones and sulfuric acid; and mineral fuels and related materials, such as uranium.

Zambia faces several internal and external obstacles to successful and sustained mineral resource development. These include cyclical world commodity prices; high transportation costs; limited national infrastructure, particularly west of the Copperbelt; increased cost of imported equipment and supplies; and the threat that high HIV/AIDS rates in the region pose to maintaining a skilled labor force.

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TABLE 1
ZAMBIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2002	2003	2004[e]	2005[e]	2006[e]
METALS						
Cobalt:						
Mine output, Co content		10,000 [e]	11,300	10,000	9,300	8,000
Metal, Co content		6,144	6,620	5,791	5,422 [2]	4,665
Copper:[3]						
Mine output, Cu content:						
By concentration or cementation		258,000	269,000	344,300 [2]	341,000	370,000
Leaching, electrowon		83,000	79,000	82,600 [2]	106,000	144,000
Total		341,000	348,000	426,900 [2]	447,000	514,000
Metal:						
Smelter, primary, includes low-grade electrowon		253,500	268,000	280,100 [2]	270,000	290,000
Refinery, primary:						
Electrowon		83,700	109,000 [e]	124,000	155,000	200,000
Other		253,100	241,000 [e]	286,000	244,000	260,000
Total		336,800	350,000 [e]	410,000	399,000	460,000
Gold	kilograms	--	--	--	440	800
Silver	do.	--	--	--	2,000	3,500
INDUSTRIAL MINERALS						
Cement		230,379	350,000 [e]	390,000	435,000	650,000
Clays:[e]						
Brick		3,000	3,000	3,300	3,300	3,300
Building, not further specified		30,000	30,000	33,000	33,000	33,000
China and ball		200	200	200	200	200
Gemstones:[e]						
Amethyst	kilograms	1,064,606 [2]	1,000,000	1,100,000	1,100,000	1,200,000
Beryl	do.	8,551 [2]	8,000	8,000	10,000	10,000
Emerald	do.	1,860 [2]	2,000	2,100	2,500	2,600
Garnet	do.	NA [2]	NA	NA	NA	NA
Tourmaline	do.	25,755 [2]	25,000	26,000	26,000	27,000
Lime, calcined	thousand metric tons	151	145 [e]	150	150	150
Limestone, for cement and lime	do.	330	690 [e]	750	750	1,200
Limestone, crushed aggregate	do.	450	600 [e]	650	650	700
Sand and gravel, construction[e]	do.	200	200	220	220	300
Sulfur:[e]						
Gross weight:						
Pyrite concentrate		225,870 [2]	226,000	280,000	285,000	290,000
Sulfuric acid[4]		10,000	10,000	12,000	12,000	15,000
Sulfur content:						
Pyrite concentrate (42% S)		94,900	95,000	118,000	120,000	122,000
Sulfuric acid (32.6% S)		3,260 [r]	3,260 [r]	3,910 [r]	3,910 [r]	4,890
Total, S content		98,200 [r]	98,300 [r]	122,000 [r]	124,000 [r]	127,000
MINERAL FUELS AND RELATED MATERIALS						
Coal, bituminous		71,700	71,800	240,000	240,000	100,000
Petroleum, refinery products[e]	thousand 42-gallon barrels	--	5,000	6,200	5,000	5,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. NA Not available. -- Zero.

[1]Table includes data available through November 16, 2007.

[2]Reported figure.

[3]Terms used are as defined by the International Copper Study Group.

[4]From the Chambishi and the Nkana acid recovery plants.

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TABLE 2
ZAMBIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement	Chilanga Cement plc (Lafarge Group, 84%)	Lusaka and Ndola plants	700,000.
Do.	do.	New plant at Lusaka	750,000.[1]
Do.	Zambezi Portland Cement Ltd.	Ndola	330,000.[1]
Coal, bituminous	Maamba Collieries Ltd. (Government, 100%)	350 kilometers south of Lusaka in the Kanzie and Izuma Basins	800,000.
Do.	Collum Coal Mining Industries Ltd.	Sinazongwe	120,000.
Copper and cobalt:			
Ore and concentrate	Kansanshi Mining plc (Kansanshi Holdings Ltd.,[2] 79.4%, and Zambia Consolidated Copper Mines Investments Holdings Plc, 20.6%)	Kansanshi Mine	12,000,000 ore.
Do.	Konkola Copper Mines plc (Vedanta Resources plc., 51%; Zambia Copper Investments Ltd., 28.4%; Zambia Consolidated Copper Mines Investments Holdings Plc, 20.6%)	Nchanga open pit	4,500,000 ore.
Do.	do.	Nchanga underground mine	2,800,000 ore.
Do.	do.	Konkola underground mine	2,400,000 ore.
Do.	do.	Fitwaola open pit	NA.
Do.	Mopani Copper Mines plc (Carlisa Investments Corp.,[3] 90%, and Zambia Consolidated Copper Mines Investments Holdings Plc, 10%)	Nkana Mine	5,500,000 ore.
Do.	do.	Mufulira Mine	2,500,000 ore.
Do.	Luanshya Copper Mines Ltd. (Enya Holdings BV,[4] 85%, and Zambia Consolidated Copper Mines Investments Holdings Plc, 15%)	Baluba underground mine	1,400,000 ore.
Do.	NFC Africa Mining plc (China Nonferrous Metal Mining Corp., 85%, and Zambia Consolidated Copper Mines Investments Holdings Plc, 15%)	Chambishi Mine	800,000 ore, which yields about 50,000 copper in concentrate.
Do.	Chibuluma Mines plc (Metorex Ltd., 65%, and Industrial Development Corp. of South Africa Ltd., 35%)	Chibuluma South Mine, about 20 kilometers from Kitwe	480,000 ore, which yields about 15,000 copper in concentrate.[5]
Smelter and refinery	Konkola Copper Mines plc (Vedanta Resources plc., 51%; Zambia Copper Investments Ltd., 28.4%; Zambia Consolidated Copper Mines Investments Holdings Plc, 20.6%)	Tailings leach plant at Chingola	80,000 copper cathode.
Do.	KCM (Smelterco) Ltd. (Vedanta Resources plc., 51%; Zambia Copper Investments Ltd., 28.4%; Zambia Consolidated Copper Mines Investments Holdings Plc, 20.6%)	Nkana copper smelter	240,000 blister copper/anode.
Do.	do.	Nkana copper refinery	180,000 copper cathode.
Do.	Mopani Copper Mines plc (Carlisa Investments Corp.,[3] 90%, and Zambia Consolidated Copper Mines Investments Holdings Plc, 10%)	Mufulira in situ leach and SX-EW[6] plant	17,000 copper cathode.
Do.	do.	Mufulira (ISASMELT) smelter[7]	200,000 copper anode.
Do.	do.	Mufulira refinery	275,000 copper cathode.
Do.	do.	Nkana heap leach	38,000 copper cathode.
Do.	do.	Nkana cobalt refinery	2,500 cobalt metal.
Do.	Chambishi Metals plc (Enya Holdings BV,[4] 90%, and Zambia Consolidated Copper Mines Investments Holdings Plc, 10%)	Chambishi cobalt plant and Nkana slag dump	27,000 copper cathode, 7,000 cobalt metal.
Do.	First Quantum Minerals Ltd.	Bwana Mkubwa SX-EW[6] plant, which treats ore from the Lonshi Mine, Congo (Kinshasa)	52,000 copper cathode.

See footnotes at end of table.

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TABLE 2--Continued
ZAMBIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Copper and cobalt--Continued				
Smelter and refinery--Continuec		Sable Zinc Kabwe Ltd. (Metorex Ltd., 100%)	Sable copper leach and electrowinning plant at Kabwe treats feed imported from concentrates produced from the Ruashi stockpiles, Congo (Kinshasa)	14,000 copper cathode, 300 cobalt carbonate.
Do.		Sino-Metals Leach Zambia Ltd. (China Nonferrous Metals Mining Co. Ltd., Sino-Africa Mining Investments Ltd., NFC Africa Mining Plc, and China Hainan Construction Co. Ltd.)	Chambishi	8,000 copper cathode.
Gemstones:				
Amethyst	metric tons	Kariba Minerals Ltd. (Gemfields Resources PLC, 50%, and Government, 50%)	Kariba Mine, about 500 kilometers from Kaloma	150.
Do.	do.	Mayfair Mining & Minerals Ltd. (Mayfair Mining & Minerals, Inc.)	Mapatizya area, about 500 kilometers from Kaloma	100.
Do.	do.	Various artisanal operations	Krystal Mine in Kaloma; Mumbwa area, near the Zimbabwean border	NA.
Aquamarine	kilograms	do.	Katete and Petauke areas	NA.
Beryl	do.	do.	Eastern Province pegmatites	NA.
Citrine	do.	do.	Iteshi Teshi, Mumbwa, and Eastern Province	NA.
Emerald	do.	Kagem Minerals Ltd. (Hagura Mining Ltd., 75%, and Government, 25%)	Kagem Mine, Ndola Rural Emerald Restricted Area	1,000.[e]
Do.	do.	Gemfields Resources PLC	Mbuva-Chibolele Mine, Ndola Rural Emerald Restricted Area	1,000.[e]
Do.	do.	Numerous artisanal and small mining operations	Ndola Rural Emerald Restricted Area	600.[e]
Garnet	do.	Various artisanal operations	Eastern Province pegmatites, Mazabuka, Siavunga, Chikankata, Gwemba Valley	NA.
Tourmaline	do.	do.	Kalunga Wbeba Mine, Eastern Province	NA.
Do.	do.	do.	Hofmeyer Mine near Nyimba	NA.
Do.	do.	Jagoda Gems Ltd.	Jagoda Mine, Mkushi	NA.
Do.	do.	Various artisanal operations	Eastern Province	NA.
Gold:				
Content of ore	do.	Kansanshi Mining plc (Kansanshi Holdings Ltd.,[2] 79.4%, and Zambia Consolidated Copper Mines Investments Holdings Plc, 20.6%)	Kansanshi Mine	1,000.
Refined	do.	NA	Ndola Precious Metals Plant (processes copper refinery slimes)	150 refined gold.
Lime, quicklime		Ndola Lime Company Limited (Zambia Consolidated Copper Mines Investment Holdings Plc, 100%)	Ndola	300,000.[8]
Petroleum, refined	42-gallon barrels	Indeni Petroleum Refinery Limited (Total Outre Mer, 50%, and Government, 50%)	Indeni refinery at Ndola	3,500,000.
Sulfur:				
Pyrite ore, gross weight		Konkola Copper Mines Plc	Nampundwe Mine, 48 kilometers west of Lusaka	300,000.
Sulfuric acid		do.	Nkana No. 3 and No. 4 acid plants	380,000.
Do.		do.	Nchanga Acid plant	180,000.
Do.		First Quantum Minerals Ltd.	Bwana Mkubwa acid plant	350,000.

See footnotes at end of table.

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TABLE 2--Continued
ZAMBIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Zinc	Sable Zinc Kabwe Ltd. (Metorex Ltd., 100%)	Zinc treatment plant at Kabwe to process Kabwe-area zinc oxide and sulfide tailings	5,000.[1]

[e]Estimated. NA Not available.
[1]Under construction.
[2]Subsidiary of First Quantum Minerals Ltd.
[3]Carlisa Investments Corp. is owned by Glencore International AG, 81.2%, and First Quantum Minerals Ltd., 18.8%.
[4]Enya Holdings BV is owned by International Mineral Resources AG and Beny Steinmetz Group Resources.
[5]Also includes some cobalt content.
[6]Solvent extraction-electrowinning.
[7]Construction of the ISASMELT smelter that had a copper-in-concentrate input capacity of 720,000 metric tons per year (t/yr) was completed at Mufulira and commissioning began in late 2006. The ISASMELT smelter replaced the old 420,000-t/yr-copper-in-concentrate-input-capacity smelter at Mufulira that had an output capacity of 160,000 t/yr of copper anode.
[8]Plant has the capacity to produce up to 5,000 metric tons of hydrated lime (slaked) from quicklime.

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The Mineral Industry of Zimbabwe

By Philip M. Mobbs

Domestic and foreign companies that produced minerals or manufactured mineral-based commodities struggled to continue operations in Zimbabwe. The negative effects of hyperinflation, which averaged 1,061% in 2006 compared with an average of 238% in 2005; frequent electrical power outages; lack of foreign currency to fund equipment imports; and chronic shortages of food, fuel, skilled manpower, and spare parts adversely affected production operations. Despite the difficulties, Zimbabwe's diverse mineral output included about 4% of the world's asbestos and chromite production, 2% of the platinum-group metals (PGM) and vermiculite production, and about 1% of the lithium production (George, 2007; International Monetary Fund, 2007; Ober, 2007; Papp, 2007; Potter, 2007; Virta, 2007).

Minerals in the National Economy

Minerals and mineral-based commodities formed a more-significant segment of national exports than in past years because of the general increase in world mineral prices and the significant reduction of exports from Zimbabwe's deteriorated commercial agricultural sector. In general, because of the various problems that restrained mineral commodity output, the companies that exported their production and the Government were not able to benefit fully from the rise in world mineral prices. Nationally, about 40 minerals or mineral-based commodities were produced, chiefly from small- and medium-scale mines (World Bank Group, The, undated).

Government Policies and Programs

The Ministry of Mines and Mining Development managed the mineral sector in accordance with the Mines and Minerals Act (chapter 21:05) and the Mining (General) Regulations, 1977. In 2006, the mineral sector remained constrained by uncertainties, which were caused by existing and proposed Government policies. The Government's foreign exchange policy often adversely affected mining and mineral-based commodity companies that exported production. In 2006, the Government proposed to amend the Mining Law to require the transfer of 51% ownership in all mining activities to the Government. The Gold Trade Act of 2006 mandated penalties for unlawful possession or trading of gold.

The Government reportedly entered into agreements to provide future mineral output as collateral for loans and to barter mineral output for goods. In May, the Reserve Bank pledged future nickel exports to European and South American banks in exchange for their setting up a $50 million fund that would pay for refined petroleum imports. In June, the Government agreed to a $1.3 billion deal to send chromite to China in return for the Chinese-funded development of additional coal-fueled electricity-generation plants, and cemented an agreement, which was valued at $60 million, to send chromite to China in exchange for radio and television transmission equipment.

In 2006, the Government signed a Southern African Development Community (SADC) protocol on finance and investment that allowed the SADC's Regional Indicative Strategic Development Plan (RISDP) to progress. The RISDP proposal included the establishment of an SADC free trade area by 2008, an SADC common market by 2015, and a single SADC currency by 2018 (Salomão, 2007).

International sanctions in effect in 2006 included those of Australia, the European Union, and the United States. Sanctions primary affected the foreign assets of and financial transactions of various Government officials of Zimbabwe.

Production

In 2006, the volume of diamond production increased by a reported 316% compared with that of 2005; graphite, by 53%; phosphate rock, 44%; chromite, 14%; and platinum-group metals, 3%. The production of cement, refined nickel, and silver also was estimated to have increased. Commodities with a significant decline in production in 2006 included iron ore, 72%; vermiculite, 42%; pyrite, 33%; coal, 27%; asbestos, 20%; and gold, 19%. Steel production also was estimated to have declined in 2006.

Structure of the Mineral Industry

Ownership of mining companies in Zimbabwe was dominated by domestic investment and mining companies and international cement and mining companies. Foreign investment was funneled primarily through the cement, diamond, gold, nickel, and PGM sectors. State-owned Zimbabwe Mining Development Corp. (ZMDC) maintained equity interest in closed copper mining and processing facilities, a diamond mining operation, and gold mines, some of which were active. Subsidiaries of state-owned Industrial Development Corp. of Zimbabwe Ltd. operated a secondary aluminum re-melt facility and produced some industrial minerals, such as clay, stone, and phosphate rock. Zimbabwe Iron and Steel Co. (ZISCO), in which the Government held majority interest, operated the crude steel plant, and a ZISCO subsidiary operated iron ore and limestone mines.

Mineral Trade

In accordance with the Minerals Marketing Corp. of Zimbabwe Act [as modified by the Minerals Marketing Corp. (Exemption) Regulations, 1983 and the Precious Stones Trade Act, 1978], state-owned Minerals Marketing Corp. of Zimbabwe (MMCZ) marketed almost all mineral production in Zimbabwe. Gold and silver was sold to Fidelity Printers and Refiners, which was a subsidiary of the Reserve Bank of Zimbabwe. PGM concentrates and smelter matte were shipped to Impala Platinum Holdings Ltd. (Implats) processing facilities in South Africa.

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Metals

Chromium and Copper.—High international metal prices encouraged exploration activity in Zimbabwe. In 2006, ZMDC and a Russian firm formed Ruscole Investments to explore for chromium on the Great Dyke. Norinco International Cooperation Ltd. of China (60% interest), Zimbabwe Defense Industries (20% interest) and ZMDC (20% interest) also formed a company to explore for chromite in the Ngezi area on the Great Dkye. The Zimbao Mining Ventures was formed by Wambao Shinex of China (51% interest) and Zimbabwe Mining Development Corp. (49% interest) to evaluate the reopening of the Mhangura and the Sanyati copper mines and the Lomangundi smelter and refining complex.

Gold.—In 2006, gold accounted for about 26% of the value of mineral production in Zimbabwe. The Government remained concerned about the significant drop in gold deliveries to the Fidelity refinery from the mines and continued its crackdown on gold smuggling and illegal gold panning.

Iron and Steel.—In March 2006, Global Steel Holding Ltd. was awarded a 20-year contract to manage and rehabilitate ZISCO's facilities; by September, however, Global Steel had walked away from the project. A subsequent investigation by the National Economic Conduct Inspectorate, which was withheld from public release, ignited a media frenzy about alleged corruption, financial mismanagement, and looting of ZISCO funds by Government Ministers, Members of Parliament, other politicians, and senior company officials (Herald, The, 2006).

Steelmakers Zimbabwe (Pvt.) Ltd. commissioned a 54,000-metric-ton-per-year (t/yr)-capacity sponge iron plant in Masvingo. Output was shipped to Steelmakers' meltshop at Redcliff as a substitute for scarce steel scrap. Steelmakers planned to expand the capacity of the sponge iron plant to 108,000 t/yr, and eventually to 162,000 t/yr (Steelmakers Zimbabwe (Pvt.) Ltd., undated).

Platinum-Group Metals.—Two major platinum mines were operational on the Great Dyke; a third was pending final approval. At Ngezi, Zimplats Holdings Ltd. mined 1.1 million metric tons (Mt) of ore from the open pit and 912,000 metric tons (t) from the underground mine in 2006. The company milled about 2.06 Mt of ore and smelted 64,877 t of concentrate. About 5.5 t of PGM was recovered from the smelter matte in South Africa and sold. Zimplats planned to end open pit mining in late 2007 and to increase production from the underground mine. The initial phase of the company's proposed expansion program projected the development of two new underground mines by 2010 (Zimplats Holdings Ltd., 2006a, b, c; 2007).

At the Mimosa Mine, the joint venture of Aquarius Platinum Ltd. of Australia (50%) and Implats (50%) completed the Wedza Phase IV project, which increased the volume of ore milled at the Mimosa underground mine to 1.8 million metric tons per year (Mt/yr) of ore from 1.4 Mt/yr. In 2006, about 1.8 Mt of ore was mined. The concentrated ore was shipped to Impala Refining Services near Rustenburg, South Africa, for processing (Impala Platinum Holdings Ltd., undated).

In 2006, Anglo Platinum Ltd. of South Africa began digging the underground access declines at the Unki project near Gweru. Anglo's final decision to proceed with the Unki project was subject to Government fiscal and regulatory approvals and the uncertainties of costs owing to Zimbabwe's hyperinflation. If approved in early 2007, initial production could start in 2009.

Industrial Minerals

Diamond.—According to statistics released by the Kimberley Process, diamond production in Zimbabwe increased to more than 1 million carats in 2006 compared with 248,262 carats in 2005. Because of differences in data gathering, Kimberley Process data does not match exactly production data received from Zimbabwe. Riozim Ltd. [a partner in Murowa Diamond (Pvt.) Ltd., which was the company that operated Zimbabwe's major commercial diamond mine near Zvishavane] reported that production of 240,026 carats in 2006 was lower than that of 2005 (251,152 carats) because of the depletion of the higher-grade open pit mine and frequent electrical power cuts. The Murowa partners began a feasibility study of a planned production capacity expansion program; the study was to take into account the potential loss of 51% of the Murowa project under the proposed amendments to the mining law (Standard, The, 2006; Antwerp Facets News Service, 2007; Kimberley Process, 2007).

A diamond rush flooded eastern Zimbabwe with informal miners in late 2006. The Exclusive Prospecting Order for the Marange area, which is located southwest of Mutare, that had been held by Kimberlitic Searches (a subsidiary of the De Beers Group), expired in March. Subsequently, African Consolidated Resources PLC (ACR) of the United Kingdom, which had several ongoing exploration programs for gold, nickel, and platinum in Zimbabwe, applied and was awarded diamond exploration and mining rights in the Marange area. By late September, when ACR announced that gem and industrial diamond had been recovered from the property, thousands of Zimbabweans were digging for diamond in the area. The MMCZ, which was the only legal diamond buyer and trader, had to compete with informal traders for the production. A significant volume of diamond was believed to have been smuggled out of the country. Up to 15,000 people had overrun the area before the Zimbabwe Army fenced off the area and removed the informal miners. In December, the Ministry of Mines cancelled ACR's title to the Marange deposit. The property was subsequently awarded to the MMCZ (African Consolidated Resources Plc, 2006).

The quality of diamond recovered from the Marange area was lower than that of diamond recovered from the Murowa and the River Ranch Mines. Despite the more than 300% increase in Zimbabwe's diamond output in 2006, the value of diamond production dropped by about 6%.

Mineral Fuels and Related Materials

Coal.—Three mining operations accounted for most of Zimbabwe's domestic coal production. In western Zimbabwe, Hwange Colliery Co. Ltd. commissioned the Chaba open

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pit mine in 2006. Hwange also produced coal for electricity generation plants and metallurgical facilities from the 3 Main underground mine. In anticipation of supplying coal for a long-proposed mine-mouth electricity-generating powerplant at Sengwa, Riozim resumed mining coal at its Sengwa Mine in late 2005. Beta Coal Ltd., which had operated the Sengwa Mine under contract to Riozim for 2 years, continued to process the mined coal for its brick-making plants. Steelmakers began coal production from a mine at Chiredzi. The coal was used at Steelmakers' sponge iron plant in Masvingo.

Petroleum.—The small oil refinery at Feruka near Mutare opened in 1965, but was closed in 1967 after United Nations Security Council Resolution 232 of December 16, 1966, imposed economic sanctions and prohibited the supply of crude oil to what was then Southern Rhodesia. In 2006, the Zimbabwe Government signed an agreement that authorized an organization affiliated with the Government of Iran to begin a feasibility study of the requirements to rehabilitate the remnants of the obsolete facility.

Uranium.—Bids were submitted to acquire the rights to develop the Kanyemba uranium deposit in the Zambezi Valley. The Mining Affairs Board approved the application of Lowenbrau Mining Services, which was a joint venture of OmegaCorp Ltd. of Australia and domestic investors. Exploration and development licenses for Kanyemba were pending at yearend awaiting additional Government approval.

Outlook

Zimbabwe has abundant mineral resources and a well developed (but deteriorated) highway and railroad network. The short-term outlook for the mining sector, however, is not favorable. Zimbabwe's rampant inflation reached 1,281% in December, and the rate is expected to continue to increase rapidly in 2007. Escalating local costs and shortages of electrical power, fuel, and skilled employees are expected to continue to affect mineral sector operations adversely in 2007.

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TABLE 1
ZIMBABWE: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004	2005	2006[p]
METALS						
Chromite, gross weight		749,339	637,099	668,391	614,720	700,001
Cobalt, metal content[3]		99	79	59	281	26
Copper:						
Mine output, concentrate, Cu content		2,502	2,767	2,383	2,570	2,581
Metal, refinery output, refined/cathode, primary[e]		7,200[4]	3,000[r]	2,000[r]	2,000[r]	2,000
Gold	kilograms	15,469	12,564	21,330	14,024	11,354
Iron and steel:						
Mine output, iron ore:						
Gross weight	thousand metric tons	272	367	283	377	104
Fe content[e]	do.	136	184	140	185	52
Metal:						
Pig iron	do.	122	182	125[r]	129[r]	70[e]
Steel, crude	do.	105	152	135[r]	107[r]	60[e]
Ferroalloys:						
Ferrochromium		258,164	245,299	193,077	218,143	200,673
Ferrosilicon chromium	thousand metric tons	--	--	1	5	1
Nickel:						
Mine output, concentrate, Ni content		8,092	9,516	9,776	8,556	8,825
Refinery output, refined metal:						
Refined from domestic materials		6,765	9,500[r,e]	9,700[r,e]	7,500[r,e]	5,500[e]
Toll refined from imported materials[5]		10,812	7,300[r,e]	6,000[r,e]	5,700[r,e]	9,000[e]
Total refined nickel metal		17,577	16,800[r,e]	15,700[r,e]	13,200[r,e]	14,500
Platinum-group metals:						
Palladium	kilograms	1,943	3,449	3,564	3,879	4,022
Platinum	do.	2,306	4,270	4,438	4,834	4,998
Rhodium	do.	218	377	374	404	410
Ruthenium	do.	178	322	300	317	317
Iridium	do.	84	152	135	141	147
Osmium	do.	NA	NA	NA	NA	NA
Total		4,729	8,570	8,811	9,575	9,894
Silver	kilograms	1,711	747	3,216	187	500[e]
Tantalum, mine output, Ta content		338	4	14	--	NA
INDUSTRIAL MINERALS						
Asbestos	thousand metric tons	168	147	104	122	97
Cement, hydraulic[e]	do.	600	400	500[r]	600[r]	700
Clays[6]		3,789	--	500[e]	500[e]	500[e]
Diamond	carats	--	--	44,454	251,152	1,046,000
Feldspar		591	246	1	--	--
Fluorspar		250	--	--	--	--
Gemstones:						
Amethyst	kilograms	NA	NA	NA	NA	NA
Emerald	do.	NA	NA	NA	NA	NA
Graphite		9,912	7,675	10,267	4,298	6,588
Kyanite		5,657	745	210	--	--
Lithium minerals, gross weight		33,172	12,131	13,710	37,499	NA
Magnesite		2,366	1,333	749	893	939
Nitrogen, N content of ammonia		60,900	56,300	47,500	45,000[e]	40,000[e]
Perlite[e]		5,000	5,000	4,000	4,000	4,000
Phosphate rock, marketable concentrate		107,854	95,496	83,391	45,705	65,838

See footnotes at end of table.

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TABLE 1--Continued
ZIMBABWE: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004	2005	2006[p]
INDUSTRIAL MINERALS--Continued						
Stone, sand and gravel:						
Granite, black		408,550	190,372	8,825	--	--
Limestone	thousand metric tons	3,169	922	41	84	50 [e]
Silica[7]	do.	6,790	2,356	1	1	--
Sulfur:						
Pyrite:						
Gross weight		87,592	93,010	81,795	59,683	39,777
S content (32.6%)		28,560	30,320	26,670	19,500	13,000
Byproduct acid, metallurgical and coal process gas, S content[e]		2,000	2,000	1,900	1,500	1,000
Total[e]		30,600	32,300	28,600	21,000	14,000
Talc		911	196	--	--	--
Vermiculite		23,803	20,016	27,150	23,045	13,421
MINERAL FUELS AND RELATED MATERIALS						
Coal, bituminous	thousand metric tons	3,721	2,872	2,476	2,891	2,107
Coke, metallurgical[e]	do.	224	228	180	200	160

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [p]Preliminary. [r]Revised. NA Not available. -- Zero.
[1]Table includes data available through October 24, 2007.
[2]In addition to the commodities listed, secondary aluminum; corundum; such gemstones as aquamarine, iolite, and tourmaline; secondary lead; and ores of tin and tungsten may be produced, but information is inadequate to estimate output.
[3]Metal includes metal content of compounds and salts and may include cobalt recovered from nickel-copper matte imported for toll refining.
[4]Reported figure.
[5]Toll-refined data includes part of the output from the Bindura Refinery and all the production from the Empress Refinery, which processes imported nickel matte from Botswana.
[6]Includes fire clay.
[7]Includes rough and ground quartz and silica sand.

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TABLE 2
ZIMBABWE: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Asbestos		African Associated Mines (Pvt.) Ltd.	Shabanie Mine, Zvishavane	2,400,000
Do.		do.	Gaths Mine, Mashava	1,400,000
Cement:				
Clinker		Portland Holdings Ltd (Pretoria Portland Cement Ltd.)	Colleen Bawn, about 115 kilometers southeast of Bulawayo	1,000,000
Portland cement		do.	Bulawayo	800,000
Do.		Circle Cement Zimbabwe Ltd. (Lafarge, S.A., 76.4%)	Harare	400,000
Do.		Sino-Zimbabwe Cement	Gweru	300,000
Chromite		Zimbabwe Mining and Smelting Co. (Pvt.) Ltd. (Zimasco Consolidated Enterprises Ltd.)	Peak Mine, Shrugwi and Netherburn Mine, Lalapanzi	250,000
Do.		Local cooperatives	Mines on the southern Great Dyke	180,000
Do.		do.	Mines on the northern Great Dyke	120,000
Do.		Zimbabwe Alloys Ltd. [Benscore Investments (Pvt.) Ltd.]	Inyala Mine	60,000
Coal		Hwange Colliery Co. Ltd. (Government, 38%; Edwards Nominees (Pvt.) Ltd, 15.46%; Messina Investments Ltd., 12.6%)	3 Main Mine and Chaba Mine, Hwange	5,000,000
Do.		Riozim Ltd.	Sengwa Colliery, about 200 kilometers northeast of Kadoma	5,000,000 [1]
Do.		Steelmakers Zimbabwe (Pvt.) Ltd.	Chiredzi, about 130 kilometers southeast of Masvingo	1,200,000 [2]
Cobalt:				
Ore, cobalt content		Bindura Nickel Corp. Ltd. (Mwana Africa PLC, 53%)	Trojan Mine at Bindura and Shangani Mine, about 100 kilometers northeast of Bulawayo	800
Hydroxide		BSR Ltd. (Bindura Nickel Corp. Ltd., 100%)	Bindura	700
Copper:				
Ore, copper content		Bindura Nickel Corp. Ltd. (Mwana Africa PLC, 53%)	Trojan Mine at Bindura and Shangani Mine, about 100 kilometers northeast of Bulawayo	1,600
Refined		Empress Nickel Refinery (Riozim Ltd.)	Eiffle Flats, near Kadoma	6,000
Diamond	carats	Murowa Diamond (Pvt.) Ltd. (Rio Tinto plc, 78%, and Riozim Ltd, 22%)	Murowa Mine, near Zvishavane	252,000
Do.	do.	River Ranch Ltd.[1]	River Ranch Mine, near Beitbridge	NA [2]
Do.	do.	Zimbabwe Mining Development Corp.[1]	Marange area	100,000 [e, 2, 3]
Gold	kilograms	Mwana Africa PLC	Freda Rebecca Mine, Bindura	2,000 [4]
Do.	do.	Riozim Ltd.	Renco Mine, 75 kilometers south-southeast of Masvingo	1,000
Do.	do.	Numerous other mines and artisanal operations	Various locations	20,000
Iron and steel:				
Crude steel		Zimbabwe Iron and Steel Co. (Pvt.) Ltd.	Redcliff, near Gweru	72,000 [5]
Ferroalloys, ferrochromium		Zimbabwe Mining and Smelting Co (Pvt.) Ltd. (Zimasco Consolidated Enterprises)	Smelter at Kwekwe	180,000
Do.		Zimbabwe Alloys Ltd. [Benscore Investments (Pvt.) Ltd.]	Smelter at Gweru	45,000
Rolled steel		Lancashire Steel (Pvt.) Ltd. [Zimbabwe Iron and Steel Co. (Pvt.) Ltd.]	Wire rod mill at Kwekwe	120,000
Do.		Steelmakers Zimbabwe (Pvt.) Ltd.	Rolling mill at Redcliff	100,000
Iron:				
Iron ore, gross weight		Buchwa Iron Mining Co. [Zimbabwe Iron and Steel Co. (Pvt.) Ltd.]	Ripple Creek Mine, near Redcliff	600,000
Sponge iron		Steelmakers Zimbabwe (Pvt.) Ltd.	Masvingo	54,000
Lithium		Bikita Minerals (Pvt.) Ltd.	Bikita Mine, 60 kilometers east of Masvingo	33,000

See footnotes at end of table.

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TABLE 2--Continued
ZIMBABWE: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Nickel:			
Ore	Bindura Nickel Corp. Ltd. (Mwana Africa PLC, 53%)	Trojan Mine at Bindura and Shangani Mine, about 100 kilometers northeast of Bulawayo	80,000
Refined metal	BSR Ltd. (Bindura Nickel Corp. Ltd., 100%)	Bindura	15,600
Do.	Empress Nickel Refinery (Riozim Ltd.)	Eiffle Flats, near Kadoma	9,000
Phosphate	Dorowa Minerals (Pvt.) Ltd. (Chemplex Corp. Ltd., 100%)	Dorowa Mine, 90 kilometers west of Mutare	155,000
Platinum-group metals:			
Ore	Zimbabwe Holdings Ltd. (Impala Platinum Holdings Ltd., 86.9%)	Ngezi Mines	2,200,000
Do.	Mimosa Investments Ltd. (Aquarius Platinum Ltd., 50%, and Impala Platinum Holdings Ltd., 50%)	Mimosa Mine, east of Zvishavane	1,800,000
Do.	Anglo American Platinum Corp. Ltd.	Unki project	1,440,000 [2]
Concentrate	Zimbabwe Holdings Ltd. (Impala Platinum Holdings Ltd., 86.9%)	Selous concentrator	2,180,000
Do.	Mimosa Investments Ltd. (Aquarius Platinum Ltd., 50%, and Impala Platinum Holdings Ltd., 50%)	Mimosa concentrator, east of Zvishavane	1,900,000
Smelter matte	Zimbabwe Holdings Ltd. (Impala Platinum Holdings Ltd., 86.9%)	Selous smelter	72,000
Pyrite	Iron Duke Pyrites (Gat Investments)	Iron Duke Mine	NA
Vermiculite	Shawa Vermiculite (Pvt.) Ltd.	Shawa Mine, near Dorowa	39,000
Do.	Dinidza Vermiculite Mining Co, (Pvt.) Ltd.	Dinidza Mine, near Dorowa	10,000

[e]Estimated. NA Not available.
[1]Ownership disputed.
[2]Under development or redevelopment.
[3]Significantly more diamond was produced from the area in 2006 during the uncontrolled diamond rush.
[4]Operations suspended.
[5]Nominal capacity 1,000,000 t/yr. Blast furnaces need refurbishment.

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The Mineral Industries of the Middle East

By Philip M. Mobbs, Glenn J. Wallace, and Thomas R. Yager

Production and processing of crude oil and natural gas formed the foundation upon which the economies of many of the countries in the Middle East region were based. Production of metals and industrial minerals was a significant factor in the economies of Iran and Turkey; besides oil and gas, metal production also was a notable factor in the economies of Bahrain, Oman, Saudi Arabia, and the United Arab Emirates. In 2006, the continued international demand for mineral fuels, especially natural gas and oil, extended the Middle East region's economic boom.

The 14 nations of the Middle East that are covered in this volume encompass an area of more than 6 million square kilometers, which is about two-thirds the size of the United States and about 4% of the world's land mass. In 2006, according to the World Bank Group (2007), the total population of the Middle East region was estimated to be about 262 million compared with 299 million for the United States and 6.5 billion for the world.

Acknowledgments

The U.S. Geological Survey (USGS) acknowledges and expresses its sincere appreciation to the Government agencies and organizations listed below for providing mineral production statistics and basic economic data.

For mineral production statistics—

- Bahrain—National Oil and Gas Authority;
- Iran—Iranian Mines and Mining Industries Development and Renovation Organization;
- Israel—Mines Authority of the Ministry of National Infrastructures;
- Jordan—Department of Statistics and the Natural Resources Authority;
- Kuwait—Ministry of Planning;
- Oman—Ministry of National Economy;
- Qatar—Central Statistical Office and the Ministry of Energy and Industry;
- Saudi Arabia—Central Department of Statistics and Information of the Ministry of Economy and Planning, and Ministry of Petroleum and Mineral Resources; and
- Turkey—General Directorate of Mining Affairs, General Directorate of Petroleum Affairs, and State Institute of Statistics.

For basic economic and population data—

- The International Monetary Fund and the World Bank Group in the United States.

General Economic Conditions

As a region, the Middle East was a major supplier of hydrocarbons to the world market. The economies of the oil-producing nations in the region were buoyed by the continued high international market prices for crude oil and natural gas. The economies of nations that were dependant on imports of refined petroleum products, however, were adversely affected. Merchandise exports of the nations that encircle the Persian Gulf were dominated by hydrocarbons; most of the region's exports of natural gas and oil were shipped to Asia, especially to China, India, Japan, the Republic of Korea, and Singapore.

The abundance of locally produced natural gas, which had resulted in the availability of low-cost electrical energy, coupled with convenient access to ocean transportation, had provided the initial justification for the region's development of energy-intensive mineral-processing operations, such as aluminum smelting; petrochemical establishments, which included fertilizer plants; and value-added minerals facilities, such as direct-reduced iron plants, plants with electric arc furnaces for the production of crude steel, and steel-rolling mills. The significant increases in local demand for natural gas and in international prices of gas during the past few years have decreased the economic feasibility of developing new projects in the region. Expansion of the nonfuel minerals sector, however, was supported by the national Governments of the area, which strongly endorsed the diversification of their respective economies into nonoil sectors.

The booming demand for consumer products was driven in part by the fast-growing, youthful population of the Middle East. The regional trend toward increased population and the significant increase in regional income associated with the high international oil prices spurred numerous projects in the construction sector; these included commercial office buildings, industrial facilities, residential housing, retail centers, and the infrastructure necessary to support the new buildings and facilities. The demands of the construction boom in the past few years have resulted in significant price increases or shortages of construction materials, such as aggregate, aluminum, cement, glass, steel beams, and steel concrete-reinforcing bar (rebar), and have strained the ability of the regional labor force to supply personnel. In 2006, equipment and material cost increases and labor shortages adversely affected the economic feasibility of the construction of new mineral industry projects or the expansion of existing facilities. An increasing number of projects were delayed (Thompson, 2006).

Investment Data and Political Risk

State-owned companies dominated the Middle East's mineral industry, although foreign investment was finding its way into the mineral sector. In 2006, the sustained international demand for minerals fueled the continued interest in the development or expansion of the mineral operations in the area. Work on planning the construction of new aluminum smelters or smelter-production-capacity expansions, new cement plants, new hydrocarbon-processing plants, and new iron-and-steel-processing facilities was underway in several countries. The expansion of the copper mining and refining capacities of state-owned facilities continued in Iran, subject to constraints based

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on the availability of Government funds. Progress was made on the internationally funded development of gold resources in Turkey, Government- and privately funded development of gold resources in Saudi Arabia, foreign-investor-funded development of nickel resources in Turkey, Government-funded development of phosphate resources in Saudi Arabia, and internationally funded development of zinc resources in Yemen.

The U.S. Government had instituted sanctions on international and U.S. company investment in Iran under Executive Order 12957 of March 15, 1995; Executive Order 12959 of May 6, 1995; Executive Order 13059 of August 19, 1997; Public Law 104-172 (The Iran Sanctions Act of 1996 [ISA], formerly the Iran-Libya Sanctions Act of 1996 [ILSA]); and Public Law 107-24 (ISA Extension Act of 2001, formerly the ILSA Extension Act of 2001). In 2006, Public Law 109-293 (Iran Freedom Support Act) extended the ISA sanctions until 2011. Although several foreign companies had entered into agreements for natural gas or oil development projects in Iran, no companies formally had been sanctioned, although they (and the Governments of their home countries) had been made aware of U.S. Government concerns.

Legislation

In Iraq, Investment law No. 13 paved the way for the Government to begin the privatization of state-owned nonfuel minerals operations. Also, work continued on a new hydrocarbons law.

Exploration

Local and international exploration companies were allowed to explore for minerals in most of the countries of the region. Government agencies engaged in mineral prospecting and general exploration included the Geological Survey of Iran, the Department of Geological Survey of the Directorate General of Minerals in Oman, the Saudi Geological Survey, the General Directorate of Mineral Research and Exploration in Turkey, and the Geological Survey and Mineral Resources Board of Yemen. In 2006, metal exploration activity was most notable in Turkey. Exploration and prospecting also were underway in Iran, Oman, Saudi Arabia, the United Arab Emirates, and Yemen. As long as high international mineral prices are sustained, additional exploration activity is expected.

In the Middle East region, exploration for crude oil and natural gas was undertaken by state-owned and international oil companies. In 2006, exploration for hydrocarbons continued in all countries of the region.

Commodity Overview

The Middle East has significant identified resources of boron minerals, bromine, crude oil, helium, natural gas, perlite, phosphate rock, and potash. In tables 5 though 18, estimates for the production of major mineral commodities for 2009 and beyond have been based upon supply-side assumptions, such as announced plans for increased production and new capacity construction and bankable feasibility studies of development projects. The outlook tables in this summary chapter show historic and projected production trends; therefore, no indication is made about whether the data are estimated or reported and revisions are not identified. Data on individual mineral commodities in tables in the individual country chapters are labeled to indicate estimates and revisions. The outlook segments of the mineral commodity tables are based on projected trends that could affect current (2006) producing facilities and on planned new facilities that operating companies, consortia, or Governments have projected to come online within indicated timeframes. Forward-looking information, which includes estimates of future production, exploration and mine development, cost of capital projects, and timing of the start of operations, are subject to a variety of risks and uncertainties that could cause actual events or results to differ significantly from expected outcomes. Projects listed in the following section are presented as an indication of industry plans and are not a USGS prediction of what will take place.

Metals

Alumina and Bauxite and Aluminum.—Bahrain and the United Arab Emirates each accounted for more than 2% of world aluminum production in 2006; as a region, the Middle East accounted for about 6% of the world's total aluminum production. Much of the produced aluminum was exported, although the increase in regional demand that was attributed to the construction sector had made additional aluminum rolling and fabrication plants more attractive investments in the region.

Regional bauxite production capacity was projected to increase by about 240% by 2011 and by about 280% by 2013 (compared with that of 2006) following the expected completion of the construction of the Saudi Arabian mineral railroad. Compared with 2006, regional aluminum production capacity was expected to increase by 27% by 2009, by about 115% by 2011, and by about 170% by 2013. The projected increase in aluminum output is attributable to the expansion of the Arak and Al Mahdi smelters in Iran and potlines 5B and 6B in the United Arab Emirates, and the construction of new smelters for South Aluminum Corp. in Iran, Sohar Aluminum Co. in Oman, Qatar Aluminium Ltd. in Qatar, Saudi Arabian Mining Co. (Ma'aden) in Saudi Arabia, and Abu Dhabi Aluminium Co. and Emirates Aluminium Co. in the United Arab Emirates (table 6). With the exception of Saudi Arabia, the proposed expansion of the region's aluminum smelter capacity was expected to greatly increase the region's demand for imports of alumina because of the limited occurrences of bauxite and the limited production of alumina in the region.

Copper.—The Middle East region was a minor contributor to the world's copper stocks. Iran was the most notable copper producer in the region. The Government of Iran's Fourth Five-Year Development Program (2005 to 2009) accounted for much of the region's planned expansion of production capacity of copper ore (through the proposed capacity expansions at the Dareh Zereshk and the Songun Mines) and refined copper (through the planned expansion of the Sarcheshmeh Refinery).

Other proposed additions to regional copper output included the proposed development of the Jabal Sayid copper deposit

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in Saudi Arabia and the planned capacity expansion at Çayeli Bakir İşletmeleri A.Ş.' copper mine in Turkey.

Gold.—The Middle East was a significant gold trading region, and the region's jewelry manufacturing sector was a noted consumer of gold; the Middle East's gold mines, however, were modest contributors to the world's supply of precious metals. Plans to increase mine output of gold significantly in Iran, Saudi Arabia, and Turkey could result in the region's gold production reaching an annual volume of about 29 metric tons (t) by 2011.

Iron and Steel.—Iron ore was produced in Iran and Turkey. Iron ore deposits in Saudi Arabia had been evaluated in the past but not developed.

The short-term demands of the regional construction boom significantly increased interest in the construction of new plants to produce rolled-steel products, such as rebar. The construction of new steel plants and the expansion of the production capacities of existing crude steel plants also were attractive projects for domestic and international investors, based on current (2006) demand.

Much of the planned expansion of iron and steel production capacity in the region was attributed to projects in the Government of Iran's Fourth Five-Year Development Program, which included the proposed construction of new crude steel plants at Ardakan, Azarbayjan, Bafq, and Sirjan and the scheduled capacity expansions at the steel plants of Iranian Steel Industries National Group, Isfahan Steel Co., Khuzestan Steel Co., and Mobarekeh Steel Co. To help meet the expected increase in raw material demand by the Iranian-steel sector, which was dominated by Government-owned companies, expansions of Iranian iron ore mining and concentration capacities were planned at the Chadormalu, the Chah Gaz, the Chuqart, the Gol Gohar, the Jalal Abad-e-Zarand, and the Sangan iron ore operations.

Other proposed new crude steel facilities in the region included the Consolidated Jordanian Iron and Steel Co. plant in Jordan, the Shadeed Iron & Steel LLC plant in Oman, the Rajhi Steel Industries plant in Saudi Arabia, and the Emirates Iron Industries plant in the United Arab Emirates. Planned increases in crude steel production capacity included the expansions of the Qatar Steel Co. plant in Qatar, Al Azizia Steel Co. Ltd. plant and the Saudi Iron and Steel Co. facilities in Saudi Arabia, and the plant of the Emirates Steel Establishment in the United Arab Emirates.

Lead and Zinc.—Projects of the Government of Iran's Fourth Five-Year Development Program accounted for most of the planned expansion of zinc ore and metal production capacities in the region. Included in the 5-year plan were the expansion of production from the Anguran lead-zinc mine and the anticipated construction of a 100,000-t/yr-capacity zinc plant in the Zanjan district. The slight projected increase in the regional lead ore production capacity was associated with the expansion of lead-zinc ore production capacity in Iran (Iranian Mines and Mining Industries Development and Renovation Organization, 2005, p. 195).

Nickel.—In Turkey, European Nickel PLC continued trial mining of the Çaldağ Mine's laterite ore while the Government processed European Nickel's forestry permit. The lack of a forestry permit delayed the planned construction of the mine's heap-leach facilities and processing plant, which originally were expected to begin in 2007. The expected date of initial nickel production was rescheduled for mid-2009. Produced nickel was to be exported.

Industrial Minerals

Phosphate Rock.—The Middle East region accounted for about 8% of the world's phosphate rock production in 2006. In Saudi Arabia, the initial production of phosphate rock from Al Jalamid deposit by Ma'aden was expected to begin in 2008. By 2011, Al Jalamid Mine was scheduled to be at full production level, which was expected to be 11.3 million metric tons per year (Mt/yr) of ore with an average grade of 18.9% phosphorous pentoxide (P_2O_5). Ma'aden planned to beneficiate the crude phosphate rock to recover about 4.5 Mt/yr of shipping concentrate, which was expected to have an average grade of 32% P_2O_5 (about 1.4 Mt/yr of P_2O_5 content). Mine operations were expected to continue for at least 27 years. Concentrate was to be shipped to a fertilizer complex to be built at Ras Az Zawr (Saudi Arabian Mining Co., undated).

Mineral Fuels and Related Materials

Coal.—Iran and Turkey were the region's coal producers. By 2011, the planned expansion of mine capacity in Iran was expected to double the country's output capacity to more than 4 Mt/yr. In Turkey, many of the smaller Government-owned coal mines had been closed in the past decade, and most of the planned new coal-fueled electricity-generating powerplants had come online. Coal production capacity was expected to stabilize at about 50 Mt/yr.

Uranium.—In Iran, uranium has been produced, but available information was inadequate to estimate output. The production capacity of the Saghand Mine was expected to be about 50 metric tons per year (t/yr) of uranium. A national project to explore for and to evaluate additional uranium deposits in central and northwest Iran was planned (Atomic Energy Organization of Iran, undated).

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TABLE 1
MIDDLE EAST: AREA AND POPULATION (2006)

Country	Area[1] (square kilometers)	Estimated population[2] (millions)
Bahrain	665	0.7
Iran	1,648,000	69.2
Iraq[1]	437,072	27.5
Israel[3]	20,770	7.0
Jordan	92,300	5.6
Kuwait	17,820	2.6
Lebanon	10,400	4.1
Oman	212,460	2.6
Qatar	11,437	0.8
Saudi Arabia	2,149,690	23.7
Syria	185,180	19.5
Turkey	780,580	72.9
United Arab Emirates	83,600	4.6
Yemen	527,970	21.6
Total	6,177,944	262.4
United States	9,161,923	299.0
World	148,940,000[4]	6,517.8

[1]Source: U.S. Central Intelligence Agency, World Factbook 2007.
[2]Source: World Bank Group, World Development Indicators 2007.
[3]Does not include Gaza Strip or the West Bank areas.
[4]Land area.

TABLE 2
MIDDLE EAST: ECONOMY IN 2006[1, 2]

Country	Gross domestic product based on purchasing power parity: Total (billion dollars)	Gross domestic product based on purchasing power parity: Per capita (dollars)	Real gross domestic product growth rate (percentage)
Bahrain	$18	$24,324	7.6
Iran	595	8,604	4.9
Iraq[3]	88	3,200	2.4
Israel[4]	216	30,686	5.2
Jordan	31	5,550	6.3
Kuwait	65	25,010	5.0
Lebanon	21	5,179	0.0
Oman	48	18,300	5.9
Qatar	31	37,440	10.3
Saudi Arabia	391	16,511	4.3
Syria	82	4,206	4.4
Turkey	671	9,200	6.1
United Arab Emirates	144	31,061	9.4
Yemen	21	971	4.0
Total	$2,422	XX	XX
United States	12,955	43,329	2.9
World	67,062	XX	5.4

XX Not applicable.
[1]Source: International Monetary Fund, World Economic Outlook Database, October 2007.
[2]Table data compiled April 2008; may be different from that presented in individual country chapters.
[3]Source: U.S. Central Intelligence Agency, World Factbook 2007.
[4]Does not include Gaza Strip or the West Bank areas.

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TABLE 3
SELECTED EXPLORATION SITES IN 2006

Country	Type[1]	Prospect	Commodity	Companies	Resource notes[2]	Exploration notes
Iran	F	Mehdiabad	Zinc, lead	Union Resources Ltd.	15.6 million metric tons of zinc; 6.2 million metric tons of lead	Feasibility study completed.
Turkey	D	Çaldağ	Nickel, cobalt	European Nickel PLC	380,000 metric tons of nickel, 22,000 metric tons of cobalt	Feasibility study completed; trial mining.
Do.	F	Çöpler	Gold	Anatolia Minerals Development Ltd.	118,000 kilograms of gold	Feasibility study completed; additional drilling.
Do.	D	Havran-Kucukdere	Gold	Koza Altin İşletmeleri A.Ş.	NA	Trial mining.

NA Not available.
[1]D--Development approved or onging. F--Feasibility work completed or ongoing.
[2]Resources reported where available based on data from various public sources. Data were not verified by the U.S. Geological Survey.

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TABLE 4

MIDDLE EAST: PRODUCTION OF SELECTED MINERAL COMMODITIES IN 2006[1]

(Thousand metric tons unless otherwise specified)

										Mineral fuels and related materials	
						Industrial minerals				Petroleum	
Country	Aluminum, metal, primary	Metals Chromite, mine output, gross weight	Steel, crude	Ammonia, N content	Cement, hydraulic	Gypsum	Phosphate rock, gross weight	Potash, K_2O equivalent		Crude, including condensate (thousand 42-gallon barrels)	Refinery products (thousand 42-gallon barrels)
Bahrain	872	--	--	360	192	--	--	--		13,085	96,217
Iran	220	225	9,800	1,020	33,000	12,000	325	--		1,530,000 e	511,000 e
Iraq	--	--	--	10 e	3,515	--	3 e	--		730,000 e	140,000 e
Israel	--	--	480 e	--	5,089	111	2,949	2,220		25	87,300
Jordan	--	--	140 e	--	3,967	334	5,805	1,040		10	30,200 e
Kuwait e	--	--	500	470	2,200	--	--	--		980,000	305,000
Lebanon e	--	--	--	--	5,000	30	--	--		--	--
Oman e	--	67	84	1,000	2,600	130	--	--		269,242 [2]	31,027 [2]
Qatar e	--	--	1,039 [2]	1,800	1,400	--	--	--		290,000	115,000
Saudi Arabia	--	--	4,000	2,000	27,055	2,200	--	--		3,347,000 [3]	715,430
Syria e	--	--	70	120	4,700	444 [2]	3,664 [2]	--		152,000 [2]	88,300
Turkey e	60	458 [3]	23,300	100	47,977 [2]	300	--	--		13,600	183,000
United Arab Emirates e	861	NA	70	380	9,800	130	--	--		900,000	207,000
Yemen e	--	--	--	--	1,550	44	--	--		133,330 [2]	38,400
Total	2,010	750	39,500	7,260	148,000	15,700	12,700	3,260		8,360,000	2,550,000
Share of world total	6%	4%	3%	6%	6%	12%	8%	11%		31%	10%
United States	2,280	--	98,200	8,520 [4]	99,700	21,100	30,100	1,100		1,860,000	3,610,000
World total	34,100	18,700	1,240,000	128,000	2,520,000	135,000	151,000	30,600		27,100,000	26,400,000

eEstimated; estimated data, U.S. data, and world totals are rounded to no more than three significant digits. NA Not available. -- Zero.

[1]Totals may not add due to independent rounding. Percentages are calculated on unrounded data. Table includes data available as of June 11, 2008.

[2]Reported figure.

[3]Includes natural gas liquids.

[4]Synthetic anhydrous ammonia; excludes coke oven byproduct ammonia.

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TABLE 5
MIDDLE EAST: HISTORIC AND PROJECTED BAUXITE MINE PRODUCTION, 1995-2013

(Metric tons)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Iran	148,000	485,130	437,595	500,000	500,000	710,000	710,000
Saudi Arabia	--	--	--	--	--	2,800,000	3,300,000
Turkey	232,278	458,537	475,349	771,227	800,000	800,000	800,000
Total	380,000	944,000	913,000	1,270,000	1,300,000	4,300,000	4,800,000

[e]Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown. -- Negligible or no production.

TABLE 6
MIDDLE EAST: HISTORIC AND PROJECTED PRIMARY AND SECONDARY ALUMINUM PRODUCTION, 1995-2013

(Metric tons)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Bahrain[1]	450,709	509,308	750,710	872,388	875,000	880,000	880,000
Iran	119,400	140,000	220,000	220,000	300,000	470,000	745,000
Oman	--	--	--	--	350,000	350,000	350,000
Qatar	--	--	--	--	50,000	585,000	585,000
Saudi Arabia	--	--	--	--	--	300,000	670,000
Turkey	61,514	61,000	60,000	60,000	60,000	60,000	60,000
United Arab Emirates	247,400	470,000	722,000	861,000	920,000	1,620,000	2,100,000
Total	879,000	1,180,000	1,750,000	2,010,000	2,560,000	4,300,000	5,400,000

[e]Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown. -- Negligible or no production.
[1]May include some secondary aluminum produced from used beverage cans.

TABLE 7
MIDDLE EAST: HISTORIC AND PROJECTED COPPER MINE PRODUCTION, 1995-2013[1]

(Metal content of concentrate in thousand metric tons)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Iran	102	125	160	208	280	350	350
Israel	--	--	--	--	11	22	22
Oman	--	--	--	--	20	20	20
Saudi Arabia	1	1	1	1	1	10	16
Turkey	24	70	54	46	56	55	55
Total	127	196	215	255	360	430	430

[e]Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown. -- Negligible or no production.
[1]Copper content of mined ore (gross weight).

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TABLE 8
MIDDLE EAST: HISTORIC AND PROJECTED REFINED COPPER METAL PRODUCTION, 1995-2013[1]

(Metric tons)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Iran	90,400	155,856	178,000	200,000	250,000	400,000	410,000
Israel	--	--	--	--	11	22	22
Oman	33,900	24,281	24,543	24,500	25,000	25,000	25,000
Turkey	100,300	64,100	95,000	106,000	100,000	100,000	100,000
Total	225,000	244,000	298,000	331,000	375,000	525,000	535,000

[e]Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown. -- Negligible or no production.
[1]May include secondary copper.

TABLE 9
MIDDLE EAST: HISTORIC AND PROJECTED GOLD MINE PRODUCTION, 1995-2013

(Metal content of ore in kilograms)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Iran	630	216	200	200	2,000	3,500	3,000
Oman	591	551	--	--	--	--	--
Saudi Arabia	8,080	3,800	7,456	5,180	11,000	12,000	12,000
Turkey	1,200	500	5,000	4,500	9,000	13,500	13,000
Total	10,500	5,100	12,700	9,900	22,000	29,000	28,000

[e]Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown. -- Negligible or no production.

TABLE 10
MIDDLE EAST: HISTORIC AND PROJECTED BENEFICIATED IRON ORE PRODUCTION, 1995-2013

(Metal content of ore in thousand metric tons)

Country	Average grade	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Iran	49%	4,500	5,800	9,162	10,000	15,000	30,000	30,000
Turkey	53%	2,750	2,200	2,450	1,730	2,000	2,100	2,200
Total		7,300	8,000	11,600	12,000	17,000	32,000	32,000

[e]Estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.

TABLE 11
MIDDLE EAST: HISTORIC AND PROJECTED CRUDE STEEL PRODUCTION, 1995-2013

(Thousand metric tons)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Iran	4,696	6,600	9,400	9,800	20,000	29,000	29,000
Iraq	300	50	--		--	--	--
Israel	200	270	480	480	480	480	480
Jordan	30	30	140	140	390	390	390
Kuwait	--	--	450	500	500	500	500
Oman	--	--	84	84	600	1,200	1,200
Qatar	614	744	1,057	1,039	1,500	1,500	1,500
Saudi Arabia	2,451	2,973	4,185	4,000	5,200	6,500	6,500
Syria	70	70	70	70	590	590	590
Turkey	12,744	14,325	20,960	23,300	25,000	25,000	26,000
United Arab Emirates	--	70	70	70	1,700	1,700	1,700
Total	21,100	25,100	36,900	39,500	56,000	67,000	68,000

[e]Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown. -- Negligible or no production.

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TABLE 12
MIDDLE EAST: HISTORIC AND PROJECTED LEAD MINE PRODUCTION, 1995-2013

(Metal content of concentrate in metric tons)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Iran	15,900	18,000	22,000	24,000	23,000	26,000	26,000
Saudi Arabia	50	50	--	--	50	50	50
Turkey	1,196	8,500	21,000	16,500	20,000	20,000	20,000
Total	17,100	27,000	43,000	41,000	43,000	46,000	46,000

[e]Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown. -- Negligible or no production.

TABLE 13
MIDDLE EAST: HISTORIC AND PROJECTED PRIMARY AND SECONDARY REFINED LEAD PRODUCTION, 1995-2013

(Metric tons)

Country[1]	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Iran	45,200	50,000	68,000	75,000	75,000	75,000	75,000
Israel	8,200	13,000	27,000	27,000	25,000	25,000	25,000
Turkey	4,000	4,000	6,000	6,000	5,000	5,000	5,000
Total	57,000	67,000	101,000	108,000	105,000	105,000	105,000

[e]Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.
[1]In addition to the countries listed, Saudi Arabia also produces secondary lead, but information is inadequate to estimate output.

TABLE 14
MIDDLE EAST: HISTORIC AND PROJECTED NICKEL MINE PRODUCTION, 1995-2013

(Metal content of ore in metric tons)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Turkey	--	--	1,000	1,000	5,000	20,000	40,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. -- Negligible or no production.

TABLE 15
MIDDLE EAST: HISTORIC AND PROJECTED ZINC MINE PRODUCTION, 1995-2013

(Metal content of ore in metric tons)

Country[1]	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Iran	145,100	90,000	167,000	164,000	165,000	180,000	180,000
Saudi Arabia	500	3,000	--	983	3,000	3,000	3,000
Turkey	9,118	39,000	50,000	80,000	80,000	80,000	80,000
Total	155,000	132,000	217,000	245,000	248,000	263,000	263,000

[e]Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown. -- Negligible or no production.
[1]In Yemen, the Jabail zinc deposit was to be developed as a zinc oxide project. Output of 70,000 metric tons (t) of zinc oxide per year was expected to start in 2009. The ore will be treated hydrometallurgically and not concentrated.

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TABLE 16
MIDDLE EAST: HISTORIC AND PROJECTED ZINC METAL PRODUCTION, 1995-2013

(Metric tons)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Iran	--	51,475	120,000	140,000	150,000	230,000	230,000
Turkey	17,050	--	--	--	--	--	--
Total	17,100	51,500	120,000	140,000	150,000	230,000	230,000

[e]Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown. -- Negligible or no production.

TABLE 17
MIDDLE EAST: HISTORIC AND PROJECTED PHOSPHATE ROCK PRODUCTION, 1995-2013

(P_2O_5 content of ore in thousand metric tons)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Iran	NA	20	40	40	40	40	40
Iraq	300	200	1	1	--	--	--
Israel	1,264	1,305	890	810	950	1,100	1,100
Jordan	1,655	1,824	2,040	1,860	1,800	1,800	1,800
Saudi Arabia	--	--	--	--	1,000	1,400	1,400
Syria	477	646	1,080	1,130	1,190	1,190	1,190
Total	3,700	4,000	4,100	3,800	5,000	5,500	5,500

[e]Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown. NA Not available. -- Negligible or no production.

TABLE 18
MIDDLE EAST: HISTORIC AND PROJECTED SALABLE COAL PRODUCTION, 1995-2013[1]

(Thousand metric tons)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Iran	1,640	2,002	1,898	2,000	3,200	4,500	4,500
Turkey	59,408	64,645	58,676	64,077	50,000	50,000	50,000
Total	61,000	66,600	60,600	66,000	53,000	55,000	55,000

[e]Estimated; estimated data and totals are rounded to no more than three significant digits; may not add to totals shown.
[1]Includes anthracite, bituminous, and lignite.

TABLE 19
MIDDLE EAST: HISTORIC AND PROJECTED URANIUM PRODUCTION, 1995-2013

(Metal content in metric tons)

Country	1995	2000	2005	2006	2009[e]	2011[e]	2013[e]
Iran[1]	--	--	NA	NA	50	50	50

NA Not available. -- Negligible or no production.
[1]Uranium may have been produced in 2005 and 2006, but information is inadequte to estimate output.

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THE MINERAL INDUSTRY OF BAHRAIN

By Philip M. Mobbs

The island Kingdom of Bahrain is located in the Gulf of Bahrain between Qatar and Saudi Arabia. Revenues associated with the production and processing of crude oil and natural gas accounted for a significant segment of the national economy. In 2006, Bahrain's total merchandise export earnings were about $11.6 billion[1] compared with $10 billion in 2005, of which Bahraini exports of crude oil and refined petroleum products were valued at about $9.2 billion in 2006 and about $7.8 billion in 2005. Aluminum exports in 2006 were valued at about $1.5 billion compared with $1.1 billion in 2005 (Central Bank of Bahrain, 2007, p. 5, 6, 9, 11).

Minerals in the National Economy

In 2006, crude oil was produced from Bahrain Field. Bahrain also sold the oil that was produced by Saudi Arabian Oil Co. from the offshore Abu Saafa Field, which straddled the Bahrain-Saudi Arabia border. The petroleum sector accounted for more than 10% of the real gross domestic product. The aluminum sector also figured prominently in the country's mineral economy. Other minerals and mineral-based commodities produced in Bahrain included cement, which was produced from imported clinker; fertilizers (ammonia and urea); methanol; and sulfur. Imported iron ore was pelleted and exported to regional steel plants. Imported petroleum coke was calcined in Bahrain for use by Aluminium Bahrain B.S.C.'s (Alba) aluminum smelter (Central Bank of Bahrain, 2007, p. 5, 9).

Production

With the addition of the fifth potline in May 2005 and the implementation of various process improvements over the years, the production capacity of Alba's plant was reported to be 850,000 metric tons (t). In 2006, Alba's output exceeded the smelter's nominal production capacity and the company reported record aluminum production of 872,388 t in the first full year of operations with 5 potlines (Aluminium Bahrain B.S.C., 2007).

Structure of the Mineral Industry

The Government held majority interest in Aluminium Bahrain B.S.C. and Bahrain Petroleum Co., B.S.C., and minority interest in companies in the aluminum rolling and petrochemical sectors. Private sector companies controlled the cement and pelleted iron ore companies.

[1]Where necessary, values have been converted from Bahraini dinars (BhD) to U.S. dollars (US$) at the rate of BhD0.376=US$1.00.

Commodity Review

Metals

Aluminum.—Alba continued to evaluate a proposed 310,000-metric-ton-per-year (t/yr)-capacity Potline 6. The lack of natural gas to power the new line remained a major impediment for the project's development (Middle East Economic Digest, 2006a).

Iron and Steel.—Proposed sector projects included the capacity expansion of the Gulf Industrial Investment Co. E.C.'s iron ore pellet plant to 6 million metric tons per year, a 90,000-t/yr-capacity stainless steel mill, and a steel complex. In 2006, Gulf Industrial Investment Co. of Kuwait acquired the remaining 50% interest in the pellet plant from Companhia Vale do Rio Doce (Maree, 2006; Metal Bulletin, 2007).

Industrial Minerals

Cement.—Arabian Gulf Cement Co. W.L.L., which was a subsidiary of Star Cement (LLC) of the United Arab Emirates, increased its production capacity to 360,000 t/yr. Falcon Cement Co. B.S.C., which was formed in 2005 by Bahrain Motor Co. and BBC Building Materials B.S.C. (Closed), which was a subsidiary of Khaleej Finance and Investment of Bahrain, proposed to build a 730,000-t/yr-capacity cement plant in the Hafeera Industrial Area of Riffa (Star Cement (LLC), undated; Middle East Economic Digest, 2006b).

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TABLE 1

BAHRAIN: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004	2005	2006[e]
Aluminum, smelter output, primary metal		518,924	531,991	531,626	750,710	872,388 [3]
Cement		66,986	129,256	153,483	191,400	192,000
Gas, natural:						
Gross	million cubic meters	12,154	12,305	12,130	13,320	13,817 [3]
Dry	do.	9,429	9,622	9,194	10,278	10,700
Methanol		405,763	370,008	398,406	375,609	375,000
Natural gas plant liquids:						
Propane	thousand 42-gallon barrels	1,099	1,021	1,032	1,065	1,070
Butane	do.	961	922	981	1,015	1,020
Naphtha	do.	1,610	1,647	1,786	1,783	1,790
Nitrogen, N content of ammonia		377,400	311,900	311,300	329,745	360,000
Petroleum:						
Crude[4]	thousand 42-gallon barrels	13,800	13,720	13,647	13,348	13,085 [3]
Refinery products:						
Liquefied petroleum gas	do.	350 [e]	350 [e]	425 [r]	452	400
Gasoline	do.	6,500 [e]	7,000 [e]	6,439 [r]	7,309	7,200
Jet fuel	do.	16,000 [e]	16,000 [e]	17,268 [r]	19,956	19,800
Kerosene	do.	3,000 [e]	5,000 [e]	2,436 [r]	1,101	1,000
Distillate fuel oil	do.	18,000 [e]	20,000	18,210 [r]	19,278	19,000
Residual fuel oil[e]	do.	26,000	29,000	28,900	29,000	28,500
Other[e]	do.	21,300	15,000	19,000	20,600	20,300
Total	do.	91,122	92,350	92,669	97,716	96,217 [3]
Sulfur		67,381	60,455 [r]	71,258	71,963	70,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised.

[1]Table includes data available through July 26, 2007.

[2]In addition, iron ore was pelleted and exported for use by direct-reduction plants. Pellets were produced from imported iron ore. Granular urea has been produced from locally produced ammonia since 1998.

[3]Reported.

[4]Does not include production from the Abu Saafa Field.

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TABLE 2
BAHRAIN: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum:				
Metal		Aluminium Bahrain B.S.C. (Government of Bahrain, 77%; SABIC Industrial Investments, 20%; Breton Investments, 3%)	Smelter at Sitra	850,000 [1]
Rolled products		Gulf Aluminium Rolling Mill Co. B.S.C. (Closed) (Government of Bahrain, 38%; Saudi Basic Industries Corp., 30%; Industrial Bank of Kuwait, 17%; Gulf Investment Corp., 6%; Government of Iraq, 5%; Government of Oman, 2%; Government of Qatar, 2%)	Rolling mill at Sitra	165,000
Do.		Midal Cables Ltd. (Intersteel W.L.L. of Bahrain, 50%, and Saudi Cable Co. of Saudi Arabia, 50%)	Rolling mill at Manama	120,000
Cement		Arabian Gulf Cement Co. W.L.L. (Star Cement Co. (LLC) of the United Arab Emirates, 100%)	Clinker grinding mill at Hidd	360,000
Iron ore, pellets		Gulf Industrial Investment Co. E.C. (Gulf Industrial Investment Co. of Kuwait, 100%)	Pellet plant at Hidd	4,000,000
Methanol		Gulf Petrochemical Industries Co. B.S.C. (Government of Bahrain, 33.3%; Petrochemical Industries Co. of Kuwait, 33.3%; Saudi Basic Industries Corp., 33.3%)	Sitra	438,000
Natural gas:				
Extracted	million cubic meters	Bahrain Petroleum Co., B.S.C. (Closed) (Government)	Bahrain Field, Ahwali	13,900
Liquids:				
Butane	thousand 42-gallon barrels	Bahrain National Gas Co. B.S.C. [Bahrain Petroleum Co., B.S.C. (Closed), 75%; Arab Petroleum Investment Corp., 12.5%; Caltex Bahrain, 12.5%]	Natural gas plant at Ahwali	1,100
Naphtha	do.	do.	do.	1,020
Propane	do.	do.	do.	1,800
Nitrogen:				
Ammonia		Gulf Petrochemical Industries Co. B.S.C. (Government of Bahrain, 33.3%; Petrochemical Industries Co. of Kuwait, 33.3%; Saudi Basic Industries Corp., 33.3%)	Sitra	438,000
Urea		do.	do.	621,000
Petroleum:				
Coke, calcined		Aluminium Bahrain B.S.C. (Government of Bahrain, 77%; SABIC Industrial Investments, 20%; Breton Investments, 3%)	do.	600,000
Crude	thousand 42-gallon barrels	Saudi Arabia Oil Co. of Saudi Arabia	Abu Saafa Field, offshore	110,000 [2]
Do.	do.	Bahrain Petroleum Co., B.S.C. (Closed) (Government)	Bahrain Field, Ahwali	13,800
Refined products	do.	do.	Sitra	95,600 [1]
Sulfur		do.	do.	72,000

[1]In 2006, actual production exceeded the facility's nominal production capacity.
[2]Production from the field is pumped to Bahrain and subsequently refined and marketed by Bahrain Petroleum Co.

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THE MINERAL INDUSTRY OF IRAN

By Philip M. Mobbs

Iran had an extensive mineral production and processing sector. Iran's hydrocarbon sector, which included the production of natural gas and oil, the refining of crude oil, and the distribution of hydrocarbons, was a significant facet of the country's economy. According to the U.S. Energy Information Administration (2007), Iran was the world's fourth ranked producer of crude oil. Iranian crude oil and condensate production averaged about 4 million barrels per day in 2006, or about 5.5% of the world's output. The country also was estimated to account for more than 1% of the world's output of cement, chromium, refined copper, and fluorspar (table 1; Edelstein, 2007, p. 21.25-21.27; Miller, 2008; Papp, 2008; van Oss, 2008).

Minerals in the National Economy

Production, processing, transportation, and sales of crude oil and natural gas accounted for about 11% of the country's gross domestic product (GDP) at constant prices. Other mineral commodities, which included coal, industrial minerals, and metals, accounted for a minor amount of the GDP (Central Bank of the Islamic Republic of Iran, 2007, p. 3).

Government Policies and Programs

The Mining Code of 1998, which was based on Articles 44 and 45 of Chapter 4 of the 1978 Constitution of the Islamic Republic of Iran, and various amendments to the Mining Code, regulated the mining sector. In 2004, a reinterpretation of the Constitution allowed private domestic and international investor participation in the mining sector. The Petroleum Act of 1987 clarified the Government's authority in the oil sector. With regard to the provisions of Article 81 of Chapter 6 of the Constitution (which prohibited foreigners from acquiring equity interest in Iran's agriculture, commercial, industrial, mineral extraction, and services sectors), adjustments, such as Note 29 of the First Five-Year Plan, and Note 22 of the Second Five-Year Plan, allowed international companies to participate in Iranian petroleum sector operations under 'buyback' contracts, which were short-term service contracts that authorized international companies to work on oil and natural gas production projects for a defined time period in return for revenue from produced oil and gas. Domestic critics of the controversial program were annoyed because buyback contracts effectively skirted the Constitution. Because most buyback contracts covered the development or redevelopment of the project and the subsequent initial production period, technical concerns were raised concerning the possibility that it would be in the economic interest of foreign commercial companies to overproduce crude oil or natural gas during the contract, which could lead to permanent reservoir damage (Ceragioli and Martellini, 2003; Oil, Gas & Energy Law Intelligence, 2003; McDowall, 2006b).

Production

Based on estimates of mineral commodity production, significant increases in output in 2006 compared with that of 2005 were projected for bauxite, borax, copper concentrate, copper metal, iron ore, refined lead, perlite, and refined zinc. Declines were projected for ferrochromium, ferrosilicon, and pig iron. Data on estimated mineral production are provided in table 1.

Structure of the Mineral Industry

The Ministry of Industries and Mines administered all mining, smelting, and refining industries except the oil and gas sectors, which were administered by the Ministry of Petroleum. Basic geologic exploration and most initial evaluations of the nation's mineral resources (except hydrocarbons) were performed by the Geological Survey of Iran.

Most of the country's active mines were privately owned, although the Government retained control of many of the larger mineral commodity companies, especially those that produced aluminum, ammonia, coal, copper, iron and steel, natural gas and oil, salt, and sulfur. In 2006, the Ministry of Industry and Mines announced that it planned to privatize some of the Government's equity interest in Bushehr Cement Co., Chadormalou Mining and Industrial Co., Darab Cement Co., Gol-e-Gohar Iron Ore Co., Iran Aluminium Co., Khouzestan Steel Co., Mobarekeh Steel Co., and National Iranian Copper Industries Co. The Government also reaffirmed its 2004 proposal to address the constitutional ban on international investors acquiring interest in the oil industry and planned to begin to privatize the downstream oil and gas sector (Iran Daily, 2006d; Middle East Economic Digest, 2006g).

Mineral Trade

The Central Bank of the Islamic Republic of Iran (2007, p. 13) reported that hydrocarbon exports were valued at about $62.5 billion[1] in Iranian year 1385 (the period from March 21, 2006, to March 20, 2007) compared with a revised value of $53.8 billion in Iranian year 1384. Crude oil exports accounted for most of the hydrocarbon exports; natural gas and refined petroleum products accounted for the remainder. In Iranian year 1385, hydrocarbons accounted for about 83% of total exports, which were valued at $75.5 billion. Exports to the United States were limited by the U.S. Government embargo on goods and services of Iranian origin. For the 2006 calendar year, Iranian exports to the United States were valued at $157 million; no mineral-commodity trade was reported (U.S. International Trade Commission, 2007; U.S. Office of Foreign Assets Control, undated).

[1]Where necessary, values have been converted from Iranian rials (RI) to U.S. dollars (US$) at the average exchange rate of RI9,197=US$1.00.

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Commodity Review

Metals

Aluminum and Bauxite and Alumina.—Construction continued on the capacity expansion of Iran Aluminium Co.'s Arak smelter to 250,000 metric tons per year (t/yr) from 120,000 t/yr (Metals Insider, 2006).

The Iranian Mines and Mining Industries Development and Renovation Organization (IMIDRO) requested bids for the construction of a 200,000-t/yr-capacity alumina plant at Sarab. The facility would process nepheline syenite from Razgah and limestone from Arshtenab. In addition to alumina, the facility was to include a 3.4-million-metric-ton-per-year (Mt/yr)-capacity cement plant, a 116,000-t/yr-capacity potassium carbonate plant, a 36,000-t/yr-capacity soda ash plant, and a 2,800-t/yr-capacity potassium sulfate plant. The winning contractor was expected to arrange the financing for the project. Construction was expected to take 3 to 4 years (Industrial Minerals, 2006).

Gold.—The increased international price of gold ignited additional interest in the development of Iran's gold occurrences. IMIDRO requested bids for the construction of the Zarshuran 2-t/yr-capacity gold mine and pressure oxidation plant at Takab. Persian Gold plc of Ireland completed a 17-hole drill program on the Chah-e-Zard prospect in Yazd. Rio Tinto Ltd. of Australia revealed that the results of a feasibility study indicated the Sari Gunay prospect in Kurdistan was not commercially viable. The Geological Survey of Iran reportedly started exploration in the Barika, the Dareh-Zaq, the Khorapeh, the Shahr-e Babak, the Tangvieh, and the Zeytounjian areas. Local companies were evaluating gold deposits in the Gandi and the Sharafabad areas (Middle East Economic Digest, 2006d; Reuters, 2006).

Iron Ore and Iron and Steel.—Gohar Zamin Iron Ore Co. requested bids for a 5-unit iron ore concentration plant and two direct-reduction iron (DRI) plants. The winning contractor was expected to arrange the financing for the project, which was to be built at the Gol-e-Gohar mining complex. Ore from the Gohar Zamin Mine, which was expected to begin operations in 2008, would feed the 10-Mt/yr-capacity concentration and DRI facility, which was expected to start operations in 2009 (Middle East Economic Digest, 2006c).

Arfa Iron and Steel Co., which was 49% state-owned, requested bids for an 800,000-t/yr-capacity steel plant in Ardakan. Arfa also proposed to build a DRI plant at the facility. Isfahan Steel Co. requested bids on a 300,000-t/yr-capacity expansion of its DRI plant at Esfahan. The winning contractor was expected to arrange the financing for the project, source iron ore feedstock, and arrange for the marketing of the DRI output. National Iranian Steel Co. requested bids on three 800,000-t/yr-capacity DRI plants. Proposed locations of the plants were to be determined at a later date (Middle East Economic Digest, 2006a, b, h).

Titanium.—In 2006, IMIDRO proposed to build a 50,000-t/yr-capacity titanium dioxide pigment plant at Kahnuj. The facility also would have a 70,000-t/yr-capacity slag processing plant and a 130,000-t/yr-capacity ilmenite beneficiation plant (Middle East Economic Digest, 2006f).

Zinc.—In 2006, Mehdiabad Zinc Co., which was a venture of IMIDRO (50% interest), Iran Itok Engineering and Technology Co. (an affiliate of Itok GmbH of Austria) (25%), and Union Resources Ltd. of Australia (25%), received a completed feasibility study of the Mehdiabad zinc project. In December, IMIDRO notified Union Resources that it had terminated the joint venture because of alleged breaches of contract. Union Resource disputed the notice of termination and attempted to settle the dispute (Union Resources Ltd., 2006).

Industrial Minerals

Cement.—Construction of new cement plants and capacity expansions at existing plants continued; more than 4 Mt/yr of capacity was added in 2006. By 2007, annual Iranian cement production capacity was expected to reach 42 Mt/yr, although production was expected to be about 36 million metric tons. The Government proposed to remove subsidies on cement prices, which resulted in a local price of cement that was equivalent to $40 per metric ton, compared with an average of about $100 in other countries in the region (Iran Daily, 2006c; Lidstone, 2007).

Nitrogen.—In early 2006, Petrochemical Industries Design and Engineering Co. of Iran won the bid to build new ammonia and urea plants for the Shiraz Petrochemical Co., which was a subsidiary of state-owned National Petrochemical Co. The new facility would include a 1.1-Mt/yr-capacity urea plant and a 670,000-t/yr-capacity ammonia plant. At yearend, Shiraz Petrochemical continued to attempt to secure domestic (Government) financing for the project (Middle East Economic Digest, 2006e).

Mineral Fuels and Related Materials

Uranium.—Limited information was available concerning uranium exploration, which continued in central and northwest Iran. Mining operations reportedly were underway at the Saghand Mine. Recovery of uranium also was reported underway at the Gchine Mine and the closed Meskani and Talmesi copper mines and their tailings piles (International Atomic Energy Agency, 2004, p. 3; Nuclear Threat Initiative, 2006; Atomic Energy Organization of Iran, undated, p. 2, 5).

Outlook

Numerous development or expansion projects are planned or underway in the aluminum, cement, copper, ferroalloys, gold, iron and steel, magnesium compounds, oil and gas, potash, stone, and zinc sectors, several of which are dominated by large state-owned companies. Although private and state-owned companies have expanded their metals processing operations during the past two decades, significant potential for additional mineral development and value-added beneficiation of minerals remains, especially in the industrial minerals sector (Iran Daily, 2006b; O'Driscoll, 2006).

Increased demand for funding other domestic programs and increased subsidies for cement and petroleum fuels have reduced the availability of Government funding for mineral resource development. The Government had a backlog of about

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9,000 development projects in various economic areas that were awaiting Government funding. The acquisition of international funding for capital-intensive development of mineral-related projects by Government-controlled and private companies operating in Iran was impaired, in part, by the Government's continued development of a nuclear-fueled electricity-generating reactor at Bushehr, which adversely affected the country's international relations. The lack of domestic and international funding is affecting the timeliness of mineral development and expansion projects. Such delays historically have resulted in increased construction costs and lost revenues (Iran Daily, 2006a; McDowall, 2006a).

More than 60% of Iranian oil production was exported in 2006. The ratio of oil exports to production, however, has declined each year since 2003, despite increased oil production. Domestic demand for crude oil is expected to continue to increase in the future, which may require Iran to forego hard currency oil exports to meet demand. Planning for the development of identified natural gas and oil resources is expected to continue, subject to funding constraints, limitations imposed by existing (2006) economic sanctions, and the specter of an international embargo on oil exports. The ongoing and often-delayed development of the multiphase South Pars natural gas project is expected to continue for a number of years. New construction and renovation of existing oil refineries is expected to begin during the current 5-year plan (2005 to 2009) (Central Bank of the Islamic Republic of Iran, 2007, p. 7).

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TABLE 1
IRAN: PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2002	2003	2004	2005[e]	2006[e]
METALS						
Aluminum:						
Bauxite, gross weight		57,254	364,306	366,000	437,595 [r, 4]	500,000
Alumina		101,339	102,785	137,002	150,000	150,000
Metal, primary ingot		168,715	182,477	212,602	220,000	220,000
Arsenic, orpiment and realgar, concentrates[e]		400	275	89 [4]	100	100
Chromite, mine output, concentrate						
Gross weight		512,640	97,328	138,755	223,563 [4]	225,000
Cr_2O_3 content[e]		250,000	48,000	68,000	110,000	110,000
Copper:						
Mine output:						
Ore mined (0.6% to 1.2% Cu):						
Gross weight	thousand metric tons	15,529	15,084	18,885	19,000	20,000
Cu content[e]		160,000	160,000	190,000	190,000	210,000
Concentrate (29% to 35% Cu):						
Gross weight		394,061	395,036	448,689	480,000 [r]	620,000
Cu content[e]		121,000	130,000	150,000	160,000 [r]	208,000
Metal:						
Smelter output, blister or anode		171,591	168,613	184,814	227,000 [r]	242,000
Refined output, cathode		143,438	145,669	152,463	178,000 [r]	200,000
Gold, mine output, Au content[5]	kilograms	210	203	195	200	200
Iron and steel:						
Ore and concentrate:						
Gross weight	thousand metric tons	16,906	18,287	18,205	19,000	21,000
Fe content[e]	do.	8,000	9,000	8,900	9,162 [r, 4]	10,000
Metal:						
Pig iron[e]	do.	2,400	2,709 [4]	2,136 [4]	2,300	2,000
Direct-reduced iron	do.	5,280	5,620	6,410	6,850	6,900
Ferrochromium[e]		8,000	10,000	7,750 [4]	8,000	7,000
Ferrosilicon[e]		40,000	40,297 [4]	50,140 [4]	50,000	45,000
Steel, crude, ingots and castings	thousand metric tons	7,293	7,869	8,382	9,400 [r]	9,800
Lead:						
Mine output, concentrate:						
Gross weight		38,054	39,093	42,018	43,000	47,000
Pb content[e]		19,000	20,000	22,000	22,000	24,000
Refinery output, includes secondary[e]		51,000	58,000	68,000	68,000	75,000
Manganese, mine output (30% to 35% Mn):						
Gross weight		123,148	115,680	128,924	125,000	125,000
Mn content[e]		42,000	38,000	43,000	42,000	42,000
Molybdenum, mine output, concentrate:						
Gross weight		4,271	4,084	3,367	4,603 [r, 4]	4,600
Mo content[e]		2,300	2,200	1,800	2,476 [r, 4]	2,500
Silver, mine output, Ag content		23	23	25	25	25
Zinc:						
Mine output, concentrate:						
Gross weight		220,000	222,000	244,006	310,000 [r]	300,000
Zn content[e]		120,000	110,000	121,000	167,000 [r]	164,000
Metal		82,571	78,428	109,400	120,000	140,000
INDUSTRIAL MINERALS						
Asbestos:						
Concentrate (3% to 8% marketable fiber)		70,000	98,000 [e]	82,018	40,000 [r]	40,000
Marketable fiber[e]		1,500	1,470 [4]	6,000	1,300 [r]	1,300
Barite		178,652	196,169	275,607	231,184 [r, 4]	230,000

See footnotes at end of table.

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TABLE 1--Continued
IRAN: PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2002	2003	2004	2005[e]	2006[e]
INDUSTRIAL MINERALS--Continued						
Boron, borax		2,079	3,361	2,142	1,660 [r]	2,000
Cement, hydraulic	thousand metric tons	28,600	30,460	32,198	32,650 [4]	33,000
Clays:						
Bentonite		125,510	140,528	193,046	261,888 [r, 4]	260,000
Industrial clays[e]		450,000	388,543 [4]	578,750 [4]	550,000	550,000
Kaolin		553,782	484,501	531,109	311,501 [r, 4]	310,000
Diatomite		1,879	9,500	8,028	1,450 [r]	1,500
Feldspar		191,316	242,898	252,713	286,033 [r, 4]	290,000
Fluorspar		32,006	47,730	54,052	64,601 [r, 4]	65,000
Gemstones, turquoise[e]	kilograms	20,000	20,000	20,000	20,000	20,000
Gypsum	thousand metric tons	13,535	13,828	12,594	11,196 [r, 4]	12,000
Industrial or glass sand (quartzite and silica)		1,878,867	1,964,965	1,880,093	1,900,000	1,900,000
Lime	thousand metric tons	2,200	2,300	2,500	2,500	2,600
Magnesite		128,565	87,795	88,194	114,708 [r, 4]	110,000
Mica		2,845	5,500	7,032	705 [r]	--
Nepheline syenite		75,000	75,500	63,798	65,000	70,000
Nitrogen:						
N content of ammonia		1,119,100	1,115,100	1,087,700	1,020,000	1,020,000
N content of urea		732,700	734,200	717,800	670,000	670,000
Perlite		20,000	26,495	31,259	31,000	40,000
Phosphate rock:						
Ore		303,000	194,000	229,575	324,166 [r, 4]	325,000
P_2O_5 content[e]		36,000	23,000	28,000	40,000 [r]	40,000
Pigments, mineral, natural iron oxide, ochre[e]		2,300 [4]	2,300	2,500	2,500	2,600
Pumice and related volcanic materials[e]		1,181,543 [4]	1,228,388 [4]	1,536,448 [4]	1,500,000	1,400,000
Salt		1,664,496	2,002,899	1,790,669	2,009,195 [r, 4]	2,000,000
Soda ash[e]		120,000	120,000	130,000	130,000	130,000
Sodium compound, caustic soda[e]		22,000	22,000	22,000	22,000	20,000
Stone:						
Construction and building, crushed[6]	thousand metric tons	19,809	21,383	25,369	25,000	25,000
Dimension and decorative:						
Granite	do.	620	838	1,019	1,000	1,000
Marble, blocks and slabs[7]	do.	3,462	4,014	4,068	4,000	4,000
Travertine, blocks	do.	728	935	1,360	1,400	1,400
Total	do.	4,810	5,790	6,450	6,400	6,400
Dolomite	do.	439	522	609	600	600
Limestone[e]	do.	41,100	46,170 [4]	50,380 [4]	50,000	50,000
Strontium, celesite[e]		2,000	2,100 [4]	7,500 [4]	672 [r]	--
Sulfates, natural:[e]						
Aluminum potassium sulfate (alum)		10,000	1,000	1,000	1,000	1,000
Sodium sulfate		580,000	580,000	600,000	600,000	600,000
Sulfur:[e]						
Byproduct of petroleum and natural gas		1,200,000 [4]	1,310,000	1,400,000	1,400,000	1,400,000
Byproduct of metallurgical processing, S content of acid		50,000	50,000	60,000	60,000	60,000
Total		1,250,000	1,360,000	1,460,000	1,460,000	1,460,000
Talc		68,007	65,833	187,465	70,600 [r]	70,000
MINERAL FUELS AND RELATED MATERIALS						
Coal	thousand metric tons	2,076	1,902	2,498	1,898 [r, 4]	2,000
Coke	do.	1,055	1,004	1,021	1,020	1,000

See footnotes at end of table.

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TABLE 1--Continued
IRAN: PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2002	2003	2004	2005[e]	2006[e]
MINERAL FUELS AND RELATED MATERIALS--Continued						
Gas, natural:[e]						
Gross	million cubic meters	120,000	125,000	137,000	150,000	160,000
Dry	do.	75,000	81,500	89,663 [4]	100,000 [r]	105,000
Plant liquids	thousand 42-gallon barrels	25,000	25,000	84,000 [r]	85,000 [r]	90,000
Petroleum:						
Crude	do.	1,250,000	1,470,000 [r]	1,500,000 [r]	1,500,000 [r]	1,530,000
Refinery products:[e]						
Liquefied petroleum gases	do.	16,000	16,000	48,100 [r]	50,000 [r]	50,000
Motor gasoline	do.	67,000	67,000	92,000 [r]	92,000 [r]	92,000
Jet fuel	do.	14,000	14,000	6,300 [r]	6,000 [r]	6,000
Kerosene	do.	46,000	46,000	52,800 [r]	53,000 [r]	53,000
Distillate fuel oil	do.	135,000	140,000	117,000 [r]	120,000 [r]	120,000
Residual fuel oil	do.	152,000	160,000	172,000 [r]	170,000 [r]	170,000
Other	do.	95,000	100,000	21,000 [r]	20,000 [r]	20,000
Total	do.	525,000	543,000	509,200 [r]	511,000 [r]	511,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. -- Zero.

[1]Table includes data available through November 16, 2007.

[2]Data are for Iranian years ending March 20 of that stated, except data for alumina, natural gas, natural-gas-plant liquids, and petroleum, which are for Gregorian calendar years.

[3]In addition to commodities listed, the following may have been produced, but information is inadequte to estimate output: antimony, bromine, ferromolybdenum, hafnium oxide, ilmenite, selenium, shell, silicomanganese, uranium, zeolite, and zirconium metal.

[4]Reported figure.

[5]Includes gold recovered from the Mouteh gold mine and from the Sarcheshmeh copper complex.

[6]Includes marble and travertine.

[7]Includes marmarite.

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TABLE 2

IRAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2006[1, 2]

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Alumina	Iran Alumina Co. (Government)	About 15 kilometers northeast of Jajarm	280
Aluminum	Iran Aluminium Co. (Iranian Mines and Mining Development and Renovation Organization)[3]	Arak	120
Do.	Almahdi Aluminium Corp. (Iranian Mines and Mining Industries Development and Renovation Organization,[3] 59.34%, and International Development Corp., 20.78%)	Bandar Abbas	110
Cement	Abadeh Cement Co.	Abedeh	175
Do.	Abyek Cement Co. (Fars & Khouzestan Cement Co.)	Abyek, 80 kilometers northwest of Tehran	2,600
Do.	Ardebil Cement Co. (Ehdasse Sanat Corp.[4] and Holcim Ltd.)	About 20 kilometers from Astara	800
Do.	Behbahan Cement Co. (Fars & Khouzestan Cement Co.)	Behbahan	960
Do.	Benvid White Cement Co.	Benvid, Isfahan	175
Do.	Bojnourd Cement Plant (Fars & Khouzestan Cement Co.)	About 37 kilometers from Bojnourd	700
Do.	Bushehr Cement Co. (Dashtestan Cement) (Ehdasse Sanat Corp.)[4]	Borazjan	1,100
Do.	Darab Cement Co. (Ehdasse Sanat Corp.)[4]	Near Shiraz	1,100
Do.	Doroud Cement Co. (Fars & Khouzestan Cement Co.)	Doroud	1,400
Do.	Ekbatan Cement Co.	Ekbatan	175
Do.	Estahban Cement Co.	Estahban	350
Do.	Faraz Firouzkhuh Cement Co. (Fars & Khouzestan Cement Co., 55%, and The Cement Tamin Co.,[5] 45%)	NA	1,200
Do.	Fars Cement Co. (Fars & Khouzestan Cement Co.)	Fars	2,000
Do.	Fars Nov Cement Co. (Fars & Khouzestan Cement Co.)	do.	1,000
Do.	Ghaen Cement Co. (Fars & Khouzestan Cement Co.)	Ghaen	770
Do.	Gharb Cement Co. (Fars & Khouzestan Cement Co.)	Kermanshah	700
Do.	Gorgon Cement Co.	NA	640 e
Do.	Hegmatan Cement Co. (Tehran Cement Co.)	East of Razan	1,120
Do.	Hormozgan Cement Co. (Sepahan Cement Co.)	About 52 kilometers west of Bandar Abbas	2,200
Do.	Ilam Cement Co. (Tehran Cement Co.)	Ilam	700
Do.	Isfahan Cement Co.	Esfahan	1,100
Do.	Karoon Cement Co.	Karoon	1,050
Do.	Kavir Kashan	Near Kashan	660
Do.	Kerman Cement Co. (Bank Melli Iran Investment Co.)	Kerman	1,260
Do.	Khash Cement Co. (Fars & Khouzestan Cement Co.)	Khash	730 e
Do.	Khazar Cement Co. (Fars & Khouzestan Cement Co.)	Khazar	640 e
Do.	Khouzestan Cement Co. (Fars & Khouzestan Cement Co.)	Ramhormoz	1,100 e
Do.	Kohkiloye Yasuj Cement (State Retirement Organization[3])	Kohkiloye	240
Do.	Kordestan Cement Co. (Sepahan Cement Co.)	North of Bijar	800 e
Do.	Mazandaran Cement Co. (Bank Melli Iran Investment Co.)	Neka	700
Do.	Mashad Cement Co.	Mashad	1,000 e
Do.	Qeshm Cement Co.	Qeshm Island	250
Do.	Oroumiyeh Cement Co.	Uroumiyeh (Urumia)	740
Do.	Oroumiyeh White Cement Co.	do.	180 e
Do.	Neyriz White Cement Co. (Fars & Khouzestan Cement Co.)	Neyriz	160
Do.	Saveh White Cement Co. (State Retirement Organization[3])	Saveh Grey Cement Factory, Saveh	2,400
Do.	do.	Saveh White Cement Factory, Saveh	350
Do.	Sepahan Cement Co.	Sepahan	2,300
Do.	Shahroud Cement Co. (Sepahan Cement Co.)	Sharoud	600
Do.	Sharg Cement Co. (Sepahan Cement Co.)	Mashhad	1,600
Do.	Shomal Cement Co. (Bank Melli Iran Investment Co.)	Shomal	880
Do.	Simansaz (Loshan) Cement Co. (Tehran Cement Co.)	Loshan	200 e
Do.	Soufian Cement Co. (Tehran Cement Co.)	Sufiyan	1,500
Do.	Tehran Cement Co.	Tehran	6,000
Do.	Yazd Bohrouk Cement Co.	Yazd	1,260

See footnotes at end of table.

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TABLE 2--Continued
IRAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2006[1, 2]

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Chromite	Faryab Mining Co.	Faryab Mine and processing plant, Minab, Hormuzgan	180 e
Do.	Esfandaghe Mines Co.	Abdasht Mine, Kerman and Suqan (Saboughan) Mine Kerman; Processing plant at Esfandaghe, Kerman	30
Do.	NA	Furumad Mine, Shahrud, Semnan; Gaft processing plant, Semnan	6
Do.	NA	Mir Mahmud Mine, Mayami, Seman	6
Do.	NA	Dumak Mine, Zahedan, Sistan va Baluchestan	2
Do.	Other companies	Other mines	30 e
Coal	Kerman Coal Co. (Iranian Mineral Production & Supply Co., 100%)[4]	Includes the Ashkli, the Babnizo, the Badamouiyeh, the Eshkeli, the Hamkar, the Hojedk, the Kamsar, the Khoshooni (Hashouni), and the Pabdana Mines	1,300
Do.	Iranian Mineral Production & Supply Co.[4]	Parvadeh 3 and 4 Mines, Tabass, Khorasan	750 6
Do.	Zirab Coal Co. (Iranian Mineral Production & Supply Co., 100%)[4]	Gajereh, Goliran, and Zirab Mines, Mazandaran	600
Do.	Shahroud Coal Co. (Iranian Mineral Production & Supply Co., 100%)[4]	Shahroud Mine, Mazandaran; Razi and Tazareh Mines, Semnan	280
Do.	Western Alborz Coal Co. (Iranian Mineral Production & Supply Co., 100%)[4]	Abyek Mine, Qazvin; Sangroud Mine, Gilan	150
Do.	Fajr Mazinoy Cooperative Co.	East Mazinoy and West Mazinoy, Khorasan	8
Copper:			
Concentrate	National Iranian Copper Industries Co. (Iranian Mines and Mining Industries Development and Renovation Organization)[3]	Sar Cheshmeh Mine, 60 kilometers south of Rafsanjan, Kerman	179
Do.	do.	Songun copper mine, Azarbaijan	45 6
Do.	do.	Meiduk copper mine, Kerman	34
Do.	do.	Qal'eh Zari Mine, near Birjand, Khorsan	10
Do.	Private cooperatives	Chah Musa Mine and Qal'eh Sukhteh, Semnan	5
Smelter output	National Iranian Copper Industries Co. (Iranian Mines and Mining Industries Development and Renovation Organization)[3]	Smelter, Sar Cheshmeh copper complex	197
Do.	do.	Smelter, Khatounabad	96
Refined metal	do.	Refinery, Sar Cheshmeh copper complex	200
Do.	do.	Electrowon plant, Sar Cheshmeh copper complex	14
Ferroalloys:			
Ferrochromium	Kerman Ferrochrome Co.	Kerman	25
Do.	Iranian Mineral Production & Supply Co.[4]	Sabzevar, Khorasan	25
Do.	Faryab Mining Co.	Faryab, Kerman	15
Do.	Navid Alloy Co.	NA	2
Ferromanganese	Faryab Mining Co.	Faryab, Kerman	15 e
Ferromolybdenum	Pars Molybden Co.	Yazd, Yazd	1
Do.	National Iranian Copper Industries Co. (Iranian Mines and Mining Industries Development and Renovation Organization)[3]	Khatounabad smelter	1.5 e
Do.	Zanjan Bronze Co.	NA	0.5 e
Ferrosilicon	Iran Ferroalloy Industries Co. (Bank of Industry and Mines, 100%)[3]	Azna, Lorestan	25
Do.	Iran Ferrosilice Co.	Semnan	25
Fluorspar	Private cooperative	Kamar Mehdi Mine, 165 kilometers southwest of Tabas	20 e
Do.	NA	Delijan Region Mines, 10 kilometers from Delijan, Markazi	6 e
Do.	NA	Kamarposht Mine, 20 kilometers from Zirab	5 e
Do.	NA	Emaft Mine, 30 kilometers from Zirab, Mazandaran	3 e

See footnotes at end of table.

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TABLE 2--Continued
IRAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2006[1, 2]

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Fluorspar--Continued		NA	Helali Gonabad Mine, 27 kilometers from Gonabad-Bajestan road	2 e
Do.		NA	Mahalat Mine, 5 kilometers from Mahalat, Markazi	2 e
Do.		NA	Pachi Miyana Mine, 30 kilometers from Zirab	2 e
Do.		NA	Jouimand Mine, 23 kilometers northwest of Gonabad, Khorasan	NA
Do.		NA	Derasele deposit	NA
Gemstones, turquoise		NA	Neyshabour Mine	6 e
Gold:				
Ore	kilograms	Iran Gold Co.	Muteh Mine (Chah Khaton and Senjedeh pits), Esfahan, and Kuh-e-Zar Mine, Semnan	600
Do.	do.	Artisanal placer operations	Neyshabour area	NA
Metal[7]	do.	National Iranian Copper Industries Co. (Iranian Mines and Mining Industries Development and Renovation Organization)[3]	Sarcheshmeh Copper Complex, Kerman	500
Iron:				
Ore		Iran Central Iron Ore Co. (National Iranian Steel Co., 100%)[4]	Choghart Mine, Bafgh, Yazd	7,400
Do.		Chadormalou Mining and Industrial Co. (National Iranian Steel Co., 100%)[4]	Chadormalou Mine, 90 kilometers north of Tchogart	6,500
Do.		Gol-e-Gohar Iron Ore Co. (National Iranian Steel Co., 100%)[4]	Gol-e-Ghar Mine, Kerman	3,800
Do.		Sangan Iron Ore Co. (National Iranian Steel Co., 100%)[4]	Sangan (Songun) Mine, Golestan	300
Do.		About 50 small privately owned mines	NA	1,000 e
Metal		Mobarekeh Steel Co. (Iranian Mines and Mining Industries Development and Renovation Organization)[3]	Direct-reduction iron plant (Midrex process) at Esfahan	4,000
Do.		Khouzestan Steel Co. (Iranian Mines and Mining Industries Development and Renovation Organization)[3]	Direct-reduction iron plant (HYL I, Midrex, and Purofer processes), Ahwaz	3,200
Do.		Isfahan Steel Co. (Iranian Mines and Mining Industries Development and Renovation Organization)[3]	Direct-reduction iron plant (Ghaem process) at Esfahan	600
Manganese		Iran Manganese Mines Co. (Takado Co.)	Venarch Manganese Mine, Qom	70
Do.		Qom Manganese Mines Co.	Shahrestouak Mine, Qom	3
Molybdenum		National Iranian Copper Industries Co. (Iranian Mines and Mining Industries Development and Renovation Organization)[3]	Sarcheshmeh Copper Complex, Kerman	NA
Natural gas	billion cubic meters	National Iranian Oil Co. (Government, 100%)	Associated gas from company oilfields	96
Do.	do.	do.	Aghar, Dalan, Kangan, and Nar gasfields	57
Do.	do.	Pars Oil and Gas Co. (National Iranian Oil Co., 100%)[3]	South Pars gasfields	32 [8]
Petroleum:				
Crude	million 42-gallon barrels	National Iranian Oil Co. (Government, 100%)	Onshore oilfields include the Agha Jari, the Ahwaz-Asmari, the Bangestan, the Hakimeh, the Gachsaran, the Karanj, the Marun, the Pazanan, and the Rag-e-Safid. Offshore oilfields include the Abouzar, and the Salman	1,400
Do.	do.	National Iranian Oil Co. and buyback contract joint venture of Shell Iran Nowrooz/Soroosh Development (70%), JJI S&N B.V. (20%), and Iranian Offshore Engineering & Construction Co. (10%)	Nowrooz and Soroosh Fields, offshore	75
Do.	do.	National Iranian Oil Co. and buyback contract joint venture of Total S.A. (55%) and Eni SpA (45%)	Doroud Field, offshore,	65
Do.	do.	National Iranian Oil Co. and buyback contract joint venture of Total S.A. (70%) and PETRONAS Carigali International Sdn Bhd (30%)	Sirri A and E Fields, offshore	40
Do.	do.	National Iranian Oil Co. and buyback contract joint venture of Total S.A. (60%) and Naftiran Intertrade Co. (40%)	Darquain Field, onshore	17

See footnotes at end of table.

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TABLE 2--Continued
IRAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2006[1, 2]

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petroleum--Continued.			
Refined products thousand 42-gallon barrels per day	National Oil Refining and Distribution Co. (Government, 100%)	Refineries at Abadan, Arak, Bandar Abbas, Esfahan, Kermanshah, Lavan, Shiraz, Tabriz, and Tehran	1,728
Phosphate rock	Phosphate Mines Development Co. (Iranian Mines and Mining Industries Development and Renovation Organization, 100%)[3]	Esfordi Mine, Yazd	360
Do.	Chadormalou Mining and Industrial Co. (National Iranian Steel Co., 100%)[4]	Chador Malu Mine	NA
Do.	Other companies	Other mines	29
Steel, crude	Mobarekeh Steel Co. (Iranian Mines and Mining Industries Development and Renovation Organization)[3]	Plant at Esfahan	4,200
Do.	Isfahan Steel Co. (Iranian Mines and Mining Industries Development and Renovation Organization)[3]	do.	2,900
Do.	Khouzestan Steel Co. (Iranian Mines and Mining Industries Development and Renovation Organization)[3]	Plant at Ahwaz	2,600
Do.	National Iranian Steel Co. (Iranian Mines and Mining Industries Development and Renovation Organization)[3]	Includes subsidiaries Iran National Steel Industrial Group plant at Ahwaz, and Khorasan Steel Co. plant near Neyshabur	1,500
Titanium, ilmenite	Kahnuj pilot plant (Iranian Mines and Mining Industries Development and Renovation Organization)[3]	Daregaz placer and Kahnuj titanium dioxide processing plant	NA
Uranium	Atomic Energy Organization of Iran (Government)	Saghand Mine, about 100 kilometers northeast of Yazd	NA
Zinc:			
Ore	Angouran Mining Company (Iran Zinc Mine Development Co.)	Angouran Mine, Zanjan	500 [9]
Do.	BAMA Co.	Irankouh complex (Goosh-e-feel, Gowd-e-Zendan, Khaneh Gorgi, Kolah Darwazeh, and Tappeh Sorkhi Mines), Esfahan	190 [9]
Do.	Bafgh Mining Co.	Kushk Mine, Yazd	120 [9]
Refined metal	Bafgh Zinc Co. (Iran Zinc Mine Development Co.)	Bafgh, Yazd	30
Do.	Qeshm Zinc Smelter Co. (affiliate of Calcimin Co.)	Qeshm Island, Hormozgan	20
Do.	National Iranian Lead and Zinc Co. (Iran Zinc Mine Development Co.)	Zanjan	15
Do.	Calcimin Co. (Iran Zinc Mine Development Co.)	Dandi (Angouran) plant, Zanjan	14
Do.	Faravari Mavad Madani Iran Co. (Iran Zinc Mine Development Co.)	Zanjan	14
Do.	Bandar Abbas Zinc Production Co. (affiliate of Calcimin Co.)	Bandar Abbas	13
Do.	Zanjan Zinc Smelter Co. (affiliate of Calcimin Co.)	Zanjan	5

[e]Estimated. NA Not available.

[1]About 2,700 mines are located in Iran, about 2,000 of which are active. About 65% of the active mines and quarries produce building and construction materials, such as aggregate, sand, and stone.

[2]Data was augmented by input from the Iranian National Committee of the World Mining Congress.

[3]Government owned.

[4]A subsidiary of state-owned Iranian Mines and Mining Industries Development and Renovation Organization.

[5]Associated with the Iranian Social Security Organisation.

[6]Under construction.

[7]Recovered from Sar Chemesh copper plant slimes.

[8]May include basic sediment and condensate.

[9]Includes lead and zinc ores

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The Mineral Industry of Iraq

By Philip M. Mobbs

Hydrocarbon production dominated the national economy of Iraq, which continued to be adversely affected by the insurgency that had engulfed the country since the 2003 military action by the United States and coalition forces. Problems with electrical power availability, security, and transportation continued to impact the rehabilitation of the country's industrial sector, especially mineral fuel production and processing. According to the Ministry of Oil, an estimated $6.3 billion was lost (oil revenue not earned and costs to repair damage) because of 159 attacks on oil industry infrastructure in 2006 (Hafidh, 2007).

Despite the armed civil conflict, crude oil production increased in 2006. Oil revenues from Iraqi oil exports were enhanced by the increase in international crude oil prices. In 2006, the value of oil exports increased by $6.5 billion to $29.7 billion. Crude oil accounted for 97% of total Iraqi exports in 2006; refined petroleum, about 2%; and all other exports, about 1%. With the exception of cement, production of other mineral and mineral-based commodities was negligible (Central Bank of Iraq, 2007, p. 64).

Production

Production of crude oil and associated natural gas was estimated to have increased in 2006, as was the production of cement. Because of limited metering of the flow of produced oil, published estimates of Iraq's average daily crude oil output varied. Testimony before the U.S. Congress released by the U.S. Government Accountability Office in 2007 noted that there was a 100,000- to 300,000-barrel-per-day difference between the average Iraqi oil production data reported by the U.S. Department of Energy's Energy Information Administration and that reported by the U.S. Department of State (Christoff, 2007, p. 9, 21-22).

Structure of the Mineral Industry

The Ministry of Industry and Minerals was responsible for the nonfuel minerals sector in Iraq. Most of the larger companies that produced or processed minerals were state owned, although there were privately owned industrial mineral operations. Investment law No. 13 of 2006 paved the way to begin the privatization of the nonfuel minerals sector.

Natural gas and petroleum were produced from Iraq's oilfields by state-owned companies. Petroleum sector activity was supervised by the Ministry of Oil. The Iraq Constitution of 2005 formed the legal basis for current (2006) hydrocarbon contracts. The new hydrocarbon law, which was being drafted at yearend 2006, was expected to be introduced for Parliamentary debate in early 2007.

Commodity Review

The mineral fuels sector of Iraq is covered extensively by the U.S. Energy Information Administration (2007). Besides hydrocarbons, the known mineral resources of Iraq were minor compared with those of other countries, although the Ministry of Industry and Minerals actively promoted the rehabilitation of the mineral sector in an attempt to diversify the national economy (Al-Bassam and Hak, 2006).

Metals

Iron and Steel.—Al Tanmia, which was a subsidiary of the Shamara Holding Co. of Jordan, began the construction of a melt shop and rolling mill at Khor az-Zubair in southern Iraq. The proposed annual output of the steel plant included 300,000 metric tons of billet (Shamara Holding Co., undated).

Industrial Minerals

Cement.—In northern Iraq, a consortium that was lead by Orascom Construction Industries of Egypt commissioned one production line of the Tasluja cement plant and completed the renovation of the plant's cement mill no. 1. Rehabilitation of clinker line no. 2 and cement mills nos. 2, 3, and 4 were scheduled to be completed in early 2007. Construction continued on the 2.9-million-metric-ton-per-year-capacity Bazian Cement Plant near Hayasi. Initial production from the Bazian plant was expected to begin in late 2007 (Orascom Construction Industries, undated; World Cement, 2006).

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TABLE 1
IRAQ: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Thousand metric tons unless otherwise specified)

Commodity[3]		2002	2003	2004	2005	2006
INDUSTRIAL MINERALS						
Cement, hydraulic:						
Portland		6,834 [4]	1,901 [4]	2,500	3,000	3,500
White		175	54 [4]	15	15	15
Nitrogen, N content of ammonia		532 [4]	90 [r, 4]	30	30	10
Phosphate rock, beneficiated, phosphorus pentoxide content		100	10	1	1	1
Salt		203 [4]	50 [4]	50	25	25
Sulfur, elemental:						
Native, Frasch		300	50	--	--	--
Byproduct[5]		50	1	20	30	30
Total		350	51	20	30	30
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross	million cubic meters	7,000	4,000	5,000	4,000	5,000
Dry	do.	2,900	1,500	1,800	1,500	1,800
Natural gas plant liquids	thousand 42-gallon barrels	4,000	2,000	9,600 [r]	9,000 [r]	10,000
Petroleum:						
Crude, including lease condensate	do.	740,000	490,000	737,940 [4]	660,000 [4]	730,000
Refinery products	do.	170,000	50,000	140,000 [r]	100,000	140,000

[r]Revised. -- Zero.

[1]Estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Table includes data available through October 5, 2007.

[3]In addition to the commodities listed, secondary aluminum, clay, fertilizers, gypsum, secondary lead, lime, limestone, industrial (glass or silica) sand, sand and gravel, and stone also may have been produced but available information is inadequate to estimate output.

[4]Reported figure.

[5]From petroleum and natural gas processing.

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TABLE 2
IRAQ: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement:				
Portland		Southern Cement Co. (Government, 100%)	Al Jinoob plant, Samawa; Al Najaf Al Ashref plant, Kufa; Al Sadaa plant, near Sadat Al Hindia; Karbala plant, Karbala; Kufa I plant, Kufa; Muthena plant, near Muthena; As Samawa plant, Samawa; and Um Qasr plant, Um Qasr	7,500,000 [1]
Do.		Iraqi Cement Co. (Government, 100%)	Al Qaim plant, Al Qaim; Al Tamim plant, Kirkuk; Fallujah plant, Fallujah; and Kubaisa plant, Kubaisa	5,200,000 [1]
Do.		Northern Cement Co. (Government, 100%)	Badoosh I, II, and III plants, Mosul; Hammam Al Alil I and II plants, Mosul; and Sinjar plant, Mosul	3,740,000 [1]
Do.		United Cement Co. (Kurdistan Regional Government)	Bazian plant at Sarchinar, near Hayasi	2,900,000 [2]
Do.		Tasluja Cement Plant (Kurdistan Regional Government)	Tasluja plant, near Suleimaniyah	2,300,000
White		Iraqi Cement Co. (Government, 100%)	Fallujah White Cement plant, Fallujah	300,000 [1]
Fertilizers		State Company for Fertilizers (Government)	Ammonia plant at Abu Al-khasib, near Basra	660,000 [1]
Do.		do.	Urea plant at Abu Al-khasib, near Basra	1,060,000 [1]
Do.		do.	Urea plant at Bayji	500,000
Do.		State Enterprise for Phosphate (Government)	Phosphatic fertilizer plant at Al-Qaim	130,000 [1]
Petroleum:				
Crude		North Oil Co. (Government)	Ain Zaleh, Ajil, Balad, Bai Hassan, East Baghdad, Jambur, Kirkuk, Sufaiya,Tikrit, and West Butmah Fields	(3)
Do.		South Oil Co. (Government)	Abu Ghraib, Amara, Burzurgan, Fakka, Halfaya, Luhais, Majnoon, Nahr Umar, North Rumaila, South Rumaila, West Qurna, and Zubair Fields	(3)
Refined products[4]	42-gallon barrels per day	Midland Refineries Co. (Government)	Daura refinery at Daura	110,000 [1]
Do.	do.	North Refineries Co. (Government)	Baiji (North and Salahudin) refineries at Baiji	310,000 [1]
Do.	do.	South Refineries Co. (Government)	Basra refinery at Basra	150,000 [1]
Phosphate rock		State Enterprise for Phosphate (Government)	Akashat	NA
Sulfur		Misraq Sulphur State Enterprise (Government)	Near Al Qayyarah	820,000 [1]

NA Not available.
[1]Actual production was significantly less than design capacity.
[2]Under construction.
[3]Average production capacity for all Iraqi fields in 2006 was about 2,000,000 barrels per day.
[4]In addition to the three large refineries, several small (7,000- to 10,000-barrel-per-day-capacity) topping plants were in various stages of repair. A 10,000-barrel-per-day-capacity plant at Najaf opened in 2006.

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The Mineral Industry of Israel

By Thomas R. Yager

In 2006, Israel played a significant role in the world's production of bromine, magnesium metal, phosphate rock, and potash. The country's share of the world's bromine production amounted to 38%; potash, 7%; magnesium metal, 4%; and phosphate rock, 2% (Jasinski, 2007; Kostick, 2007; Kramer, 2007; Lyday, 2007). Other domestically significant mining and mineral processing operations included aggregates, cement, diamond cutting and polishing, natural gas, and petroleum products. Israel was not a globally significant consumer of minerals.

Minerals in the National Economy

In 2006, the mining and quarrying and nonmetallic mineral products sectors each accounted for about 0.7% of the gross domestic product (GDP), and the manufacture of iron, steel, and other metals, about 0.2%. The remainder of the manufacturing sector (which included diamond cutting and polishing, fertilizer production, and petroleum refining) accounted for 12.9% of the GDP. The nonmetallic minerals sector employed about 9,300 workers, and the mining and quarrying sector, about 3,300. Israel's total exports amounted to $39.7 billion in 2005, of which diamond accounted for 15.5%; mining and quarrying, 1.3%; and nonmetallic mineral products, 0.7% (Central Bureau of Statistics, 2007, p. 606, 669, 698, 754, 759, 761).

Production

In 2006, the production of bromine declined by nearly 14%; magnesium, 12%; and phosphate rock, 9%. Natural gas output increased by 40%. From 2002 to 2006, steel production increased by an estimated 167%; potash, 14%; and cement, 11%. In the same period, cut diamond production declined by 46%; phosphate rock, 28%; and crushed stone, 11%.

Structure of the Mineral Industry

Most of Israel's mining and mineral processing operations were privately owned, including the producers of aggregates, bromine, cement, lime, magnesium, natural gas, phosphate rock, potash, and salt. The petroleum refineries were state-owned.

Commodity Review

Metals

Copper.—Altos Hornos de México S.A. de C.V. (AHMSA) planned to reopen the Timna copper mines, which had been shut down for more than 20 years. The cost of the project was estimated to be nearly $200 million; AHMSA spent about $25 million in 2006. The company planned to produce and export 45,000 metric tons per year (t/yr) of refined copper starting in 2009 (Global Mining News, 2005; Embassy of Israel in Mexico, 2007).

Magnesium.—Dead Sea Magnesium Ltd. (DSM) [Israel Chemicals Ltd. (ICL), 65%, and Volkswagen AG of Germany, 35%] produced about 24,500 metric tons (t) of magnesium metal in 2006 compared with 27,853 t in 2005. Magnesium alloys accounted for about 52% of DSM's sales, and magnesium metal, 48% (Israel Chemicals Ltd., 2007, p. 79, 82).

Industrial Minerals

Bromine.—In 2006, Dead Sea Bromine Group (DSBG) (a subsidiary of ICL) produced about 179,000 t of bromine compared with 207,048 t in 2005. The company consumed about 80% of its bromine for the manufacture of bromine compounds. DSBG planned to increase its capacity to 280,000 t/yr in 2008 from 240,000 t/yr (Israel Chemicals Ltd., 2007, p. 50, 57).

Phosphate Rock.—Mining of phosphate rock by Rotem Amfert Negev Ltd. (a subsidiary of ICL) declined to about 2.94 million metric tons (Mt) in 2006 from 3.24 Mt in 2005. Rotem consumed about 90% of its output for the manufacture of phosphate fertilizers and phosphoric acid; fertilizer production declined to about 1.61 Mt in 2006 from 1.64 Mt in 2005 (Israel Chemicals Ltd., 2007, p. 31, 35).

Potash.—Dead Sea Works (DSW) (a subsidiary of ICL) experienced a decline in its domestic potash production to 2.22 Mt in 2006 from 2.26 Mt in 2005. By 2008, DSW planned to increase its potash production capacity by 250,000 t/yr by using fewer of its brine ponds for salt precipitation and more for carnallite precipitation (Israel Chemicals Ltd., 2007, p. 35).

Mineral Fuels

Natural Gas.—In 2006, natural gas output increased to 2.31 billion cubic meters from nearly 1.66 billion cubic meters in 2005 because of higher output from the Mari-B gasfield in the Mediterranean Sea. Noble Energy, Inc. of the United States expected its production to increase in 2007 as more power stations are converted to natural gas (Noble Energy, Inc., 2007, p. 12, 33).

Outlook

Bromine, natural gas, and potash production is likely to increase by 2009, and copper production is expected to be restarted. The production trends for the cement, crushed stone, and sand industries will depend on the strength of the domestic economy.

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TABLE 1
ISRAEL: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004	2005	2006
METALS						
Iron and steel, steel, crude[e]		180,000 r	180,000 r	370,000 r	480,000 r	480,000
Lead, refined secondary		22,000	25,000	27,000	27,000 e	27,000 e
Magnesium metal		26,000	26,000	28,000	27,853	24,581
INDUSTRIAL MINERALS						
Bromine, elemental		185,000	176,000	202,000	207,048	179,493
Caustic soda		NA r	NA r	NA r	NA r	NA
Cement, hydraulic	thousand metric tons	4,584	4,632	4,494	5,093	5,089
Clays:						
Brick clay		35,672	36,256	65,732	54,586	54,925
Common clay		998,193	892,658	850,000	1,072,491	1,003,169
Flint clay		--	--	--	2,200	6,761
Fuller's earth		-- r	-- r	-- r	-- r	--
Diamond[3]	thousand carats	1,188	771	800 r,e	807 r	641
Gypsum		123,119	141,000	124,678	106,798	110,754
Lime		751,857	702,373	113,102	165,894	158,264
Magnesia, Mg content		NA r	NA r	NA r	NA r	NA
Magnesium chloride		126,000	130,000	137,000	134,370	114,333
Phosphate:						
Phosphate rock, mine output:						
Beneficiated	thousand metric tons	4,091 r	3,708 r	3,290 r	3,236 r	2,949
P_2O_5 content	do.	1,100 r	1,000 r	900 r	890 r	810
Phosphatic fertilizers, P_2O_5 equivalent:						
Monoammonium phosphate		13,000	12,000	12,000	12,000 e	12,000 e
Triple superphosphate		108,000	202,000	170,000	160,000 e	150,000 e
Phosphoric acid, P_2O_5 equivalent		567,000	580,000	543,000	520,000 e	510,000 e
Potash, K_2O equivalent	thousand metric tons	1,950	1,990	2,170	2,260	2,220
Salt, marketed	do.	392 e	376 e	385	406	434
Sand:						
Silica sand		209,347	210,815	196,330	196,254	204,190
Other[e]	thousand metric tons	6,000	6,000	6,000	7,000	7,000
Stone:						
Crushed[e]	do.	49,000	44,000	41,000	38,000	43,500
Dimension, marble		106,302	68,605	30,935 r	70,000 r,e	83,000 e
Sulfur:						
Byproduct from petroleum	thousand metric tons	36	45	42	44	45 e
Sulfuric acid:						
Gross weight	do.	1,956	1,894	1,789	1,700 e	1,700 e
S content	do.	639	619	581	550 e	550 e

See footnotes at end of table.

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TABLE 1--Continued
ISRAEL: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004	2005	2006
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross	million cubic meters	9	8	1,193	1,655	2,313
Dry	do.	4 e	3 e	498	686	960
Petroleum:						
Oil shale		457,900	436,500	439,200	428,900	452,000
Crude	42-gallon barrels	33,438	27,396	23,135	21,798 r	24,510
Refinery products:						
Liquefied petroleum gas	thousand 42-gallon barrels	5,591	5,500	6,170	5,650	5,461
Gasoline	do.	18,863	19,034	21,046	21,114	22,108
Naphtha	do.	3,798	4,376	3,722	4,066	3,430
Kerosene	do.	7,886	8,639	8,555	9,549	9,041
Distillate fuel oil	do.	21,169	22,208	20,516	22,185 r	24,104
Residual fuel oil	do.	22,432	22,910	21,098 r	21,827 r	21,463
Other	do.	2,007	2,151	1,835	1,696	1,700 e
Total	do.	81,746	84,818	82,942 r	86,087 r	87,300 e

eEstimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. rRevised. NA Not available. -- Zero.

[1]Table includes data available through Sepember 17, 2007.

[2]In addition to the commodities listed, imported gemstones are cut; and potassium nitrate, secondary refined zinc, such fertilizers as monopotassium phosphate, and a variety of crude construction materials are produced, but available information is inadequate to make estimates of output.

[3]Imported diamond cut in Israel.

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TABLE 2
ISRAEL: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity
Aggregates		Lime & Stone Production Company Ltd. [Housing & Construction Holding Company Ltd., 50%, and Readymix (Israel) Ltd., 50%]	15 quarries	15,000.[e]
Bromine		Dead Sea Bromine Group (DSBG) [Israel Chemicals Ltd. (ICL), 100%]	Sdom	240.
Cement		Nesher Israel Cement Enterprises Ltd. (Clal Industries and Investments Ltd., 75%)	Ramla	5,000 clinker; 3,600 cement.
Do.		do.	Haifa	2,000 clinker; 450 cement.
Do.		do.	Har Tuv	1,000 clinker; 700 cement.
Flint clay and quartz		Negev Industrial Minerals Ltd. (subsidiary of Doraz D.R.)	Mactesh Ramon	25.
Lead, refined, secondary		Harkunas Lead Works	Ashdod	25.
Lime		Lime & Stone Production Co. Ltd.	NA	170.
Do.		Negev Industrial Minerals Ltd.	Mishor Rotem	90.
Magnesium:				
Magnesia		Dead Sea Periclase Ltd. (DSP) (Israel Chemicals Ltd., 100%)	do.	95.
Do.		Tateho Dead Sea Fused Magnesia Co. [Dead Sea Periclase Ltd. (DSP), 50%, and Tateho Chemical Industries Co. of Japan, 50%]	do.	13.
Magnesium, refined		Dead Sea Magnesium Ltd. (DSM) (Israel Chemicals Ltd., 65%, and Volkswagen AG of Germany, 35%)	Sdom	34.
Natural gas	million cubic meters	Samedan, Mediterranean Sea Inc. (Noble Energy, Inc., 100%)	Mari-B gasfield	6,200.
Petroleum:				
Crude	thousand 42-gallon barrels	Lapidoth Israel Oil Prospectors Corp.	Heletz-Brur	22.
Do.	do.	do.	Kochav	9.
Refined	do.	Oil Refineries Ltd. (Government, 100%)	Haifa	58,400.
Do.	do.	do.	Ashdod	36,500.
Phosphate:				
Phosphate rock		Rotem Amfert Negev Ltd. (Israel Chemicals Ltd., 100%)	Arad, Oron, and Zin	4,500.
Phosphatic fertilizers		do.	Rotem	1,700.
Do.		Haifa Chemicals Ltd.	Haifa	NA.
Phosphoric acid[1]		Rotem Amfert Negev Ltd.	Rotem	640.
Do.		Haifa Chemicals Ltd.	Haifa	NA.
Potash		Dead Sea Works (DSW) (Israel Chemicals Ltd., 100%)	Sdom	2,800.
Salt		do.	do.	700.
Do.		Israel Salt Industries Ltd. (subsidiary of Danker Group)	Eliat	150.
Do.		do.	Kalia	60.
Do.		do.	Atlit	16.
Sand		Negev Industrial Minerals Ltd.	Mactesh Htira	300.
Steel:				
Crude		Hod Metals	Akko	300.
Do.		Yehuda Steel Ltd.	Ashdod	180.
Billet		do.	Bene Ayish	200.
Do.		do.	Ashdod	180.
Rebar		do.	Bene Ayish	200.
Do.		do.	Ashdod	120.
Do.		Hod Metals	Kiryat Gat	300.
Sulfur		Oil Refineries Ltd.	Ashdod	40.
Do.		do.	Haifa	33.
Sulfuric acid		Rotem Amfert Negev Ltd.	Rotem	NA.
Zinc		Numinor Chemical Industries Ltd.	Maalot	NA.

[e]Estimated; estimated data are rounded to no more than three significant digits. NA Not available.

[1]P_2O_5 equivalent.

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THE MINERAL INDUSTRY OF JORDAN

By Thomas R. Yager

In 2006, Jordan played a significant role in the world's production of bromine, phosphate rock, and potash. The country's share of the world's bromine production amounted to 8%; and of phosphate rock and potash, 4% each. Other domestically significant mineral processing operations included cement and petroleum products (Jasinski, 2007; Kostick, 2007; Lyday, 2007). Jordan was not a globally significant consumer of minerals.

Minerals in the National Economy

In 2005 (the latest year for which data were available), the output of the manufacturing sector amounted to 20.6% of the gross domestic product (GDP). In 2006, mineral extraction industries accounted for 3.9% of the GDP, and mineral manufacturing industries, 3.5%. Mineral extraction industries accounted for 14.4% of Jordan's exports in 2006, and mineral manufacturing industries, 8.4% (Central Bank of Jordan, 2007, p. 83; Natural Resources Authority, 2007).

Production

In 2006, the production of gravel and crushed rock declined by 15%; phosphate rock, 9%; potash; 7%; phosphoric acid, 6%; dimension stone, 6%; petroleum products, 5%; and cement, 2%. The production of phosphatic fertilizers increased by 10%; bromine, 5%; and sulfuric acid, 4% (Natural Resources Authority, 2007).

Structure of the Mineral Industry

Many of Jordan's significant mining and mineral processing operations (bromine, cement, phosphate rock, phosphatic fertilizers, phosphoric and sulfuric acid, and potash) were owned by a mixture of Government and private interests. In 2006, Brunei Investment Agency purchased a 37% share in Jordan Phosphate Mines Company (JPMC).

Commodity Review

Metals

Iron and Steel.—Jordan Steel Company was the leading domestic producer of steel. The company's production of semimanufactured steel increased to 181,000 metric tons (t) in 2006 from 167,000 t in 2005; national steel consumption increased to 600,000 t from 500,000 t. Jordan Steel and Consolidated Jordanian Iron and Steel Industry Ltd. planned to complete a new plant to remelt scrap steel with a capacity of 250,000 metric tons per year (t/yr) in May 2007 (Arab Steel, 2007).

Industrial Minerals

Cement.—National cement production declined to about 3.97 million metric tons (Mt) in 2006 from 4.05 Mt in 2005. From 2002 to 2006, cement exports declined to 20,661 t from 867,491 t as domestic consumption increased to 4.07 Mt from 2.66 Mt (Natural Resources Authority, 2007).

Jordan Cement Factories Company Ltd. (JCFC) had two plants with a combined capacity of 4.6 million metric tons per year (Mt/yr). In 2008, JCFC planned to increase its capacity to 5.5 Mt/yr. The Kuwaiti-Jordanian Finance Company announced plans to build a new cement plant in southeastern Jordan. The plant was expected to have a capacity of 1.5 Mt/yr and to be completed in 2008 at a cost of $230 million. Al-Hasa Company for Cement and Building Materials Industries Ltd. planned to complete a new cement plant near Al-Hasa. The plant was expected to have a capacity of 1.5 Mt/yr and to be completed in early 2007 at a cost of $240 million. Arabian Cement Company Ltd. of Saudi Arabia planned to start construction of a new cement plant near Al-Qatrana with a capacity of about 1.8 Mt/yr in mid-2007. The plant was expected to be completed in 2009 at a cost of $220 million (Allaf, 2006; Middle East Economic Digest, 2006a).

Phosphate Rock.—JPMC produced phosphate rock at the Al-Abiad, the Al-Hassa, and the Eshidiya Mines. In 2006, production declined to 5.8 Mt from 6.37 Mt in 2005. JPMC's exports of phosphate rock amounted to about 3.26 Mt in 2005; about 2.33 Mt was consumed domestically in the production of phosphoric acid and phosphatic fertilizers (Natural Resources Authority, 2007).

Potash.—Arab Potash Company Ltd. (APC) was one of the world's leading potash producers. In 2006, the company's production declined to 1.7 Mt from 1.83 Mt in 2005 because of inefficiencies in harvesting operations. APC planned to increase its capacity by 450,000 t/yr by the end of 2008. In 2006, India accounted for 29% of APC's 1.64 Mt of potash sales; Malaysia, 13%; and domestic consumers, 11%. Domestic consumers included Kemira Arab Potash Company, which produced potassium nitrate fertilizer (Arab Potash Company Ltd., 2007, p. 9, 16, 26).

Mineral Fuels

Petroleum.—The Jordan Petroleum Refinery Company (JPRC) operated Jordan's only refinery at Zarqa. In 2006, JPRC's production declined by about 5%. JPRC planned to expand the refinery to a capacity of 130,000 barrels per day and reduce the sulfur content of its products. The expansion and upgrades were expected to cost $700 million and to be completed in 2010 or 2011. Royal Dutch/Shell Group planned to explore for petroleum in the Azraq and the Al-Jafr Blocks in central Jordan, and Sonoran Energy Inc. of the United States, in

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the Azraq Block (Middle East Economic Digest, 2006b; Central Bank of Jordan, 2007, p. 88).

Outlook

The production of cement, potash, refined petroleum products, and steel is likely to increase in the near future because of expansions and the construction of new plants. The outlook for bromine, phosphate rock, phosphatic fertilizers, and phosphoric acid depends heavily on world market conditions.

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TABLE 1
JORDAN: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2002	2003	2004	2005	2006
Bromine		--	--	34,000 r,e	66,000 r,e	69,000 e
Cement, hydraulic	thousand metric tons	3,558	3,515	3,908	4,046	3,967
Clay:						
Common clay		484,951 r	492,583	608,390	618,127 r	642,617
Kaolin		162,786 r	217,248 r	216,566	168,264 r	112,787
Feldspar		530	13,057	13,063 r	1,000 r	11,054
Gypsum		11,252	63,895	135,331	344,991 r	333,710
Lime		10,753 r	10,108	7,154	14,505 r	11,591
Magnesia		--	--	24,000 r	--	--
Natural gas, dry	million cubic meters	255	288	294	241 r	251
Petroleum:						
Crude	42-gallon barrels	11,000	9,839	10,372 r	8,540 r	10,047
Refinery products:						
Liquefied petroleum gas	thousand 42-gallon barrels	1,577	1,485	1,299	1,400 e	1,300 e
Gasoline	do.	5,383	5,084	4,938	5,300 e	5,100 e
Jet fuel	do.	1,650	2,109	1,578	1,700 e	1,600 e
Kerosene	do.	1,608	1,484	1,252	1,300 e	1,200 e
Distillate fuel oil	do.	8,139	8,579	9,116	9,700 e	9,200 e
Residual fuel oil	do.	7,911	7,759	10,097	11,000 e	10,500 e
Asphalt	do.	1,066	1,200	1,300 e	1,400 e	1,300 e
Total	do.	27,334	27,700	29,600 e	31,800 e	30,200 e
Phosphate:						
Phosphate rock, mine output:						
Gross weight	thousand metric tons	7,134 r	6,650 r	6,188 r	6,375	5,805 2
P_2O_5 content	do.	2,280 r	2,130 r	1,980 r	2,040 r	1,860
Diammonium phosphate, P_2O_5 content		NA r	NA r	NA r	NA r	NA
Phosphatic fertilizers		694,655	637,586	887,442	800,057	881,890
Phosphoric acid		681,611 r	628,280 r	606,273 r	587,400 r	554,456
Potash:						
Crude salts	thousand metric tons	1,959 r	1,961	1,941 r	1,829 r	1,699
K_2O equivalent	do.	1,191	1,190	1,182 r	1,115	1,040 e
Salt		406,652	11,976	28,750 r	29,500 r	28,800
Sand:[3]						
Silica		13,340 r	33,210 r	46,900 r	147,000 r	415,800
Other	thousand metric tons	7,467 r	8,359 r	17,360 r	14,980 r	2,659
Steel:[e]						
Crude		134,000 2	135,000 2	140,000	140,000	140,000
Semimanufactured		290,000	290,000	310,000	350,000	360,000
Stone:						
Basalt[4]	cubic meters	1,818	--	6,976	--	8,529
Dimension, worked	thousand meters	16,902 r	13,578	6,560	6,071 r	5,688
Gravel and crushed rock:						
Basalt	thousand cubic meters	--	--	--	901	--
Marble	do.	21	--	50	27	33
Other	do.	10,605	14,266	14,932	15,805	14,150
Granite	cubic meters	13,483	1,423	--	3,558	3,536
Marble[4]	do.	59,084 r	20,685	27,650	43,956 r	37,911
Pozzolanic material		90,540	378,513	454,693	424,447	552,349
Travertine		6,000	7,632	4,141	10,780	9,048
Zeolite tuff		4,520 r	1,490 r	1,533 r	2,282 r	1,000
Sulfuric acid:						
Gross weight	thousand metric tons	1,055 r	961 r	1,103 r	1,047 r	1,092
S content	do.	345 r	314 r	361 r	342 r	357

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. -- Zero. NA Not available.
[1]Table includes data available through October 31, 2007.
[2]Reported figure.
[3]Reported as cubic meters and converted to metric tons.
[4]Other than gravel and crushed rock.

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TABLE 2
JORDAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Thousand metric tons unless otherwise specified)

Country and commodity		Major operating companies	Location of main facilities	Annual capacity[1]
Bromine		Jordan Bromine Company [Arab Potash Company Ltd. (APC), 50%, and Albemarle Corp., 50%]	al-Safi	100.[e]
Cement		Jordan Cement Factories Company Ltd. (JCFC) (LaFarge Group, 50%)	Fuheis and Rashadia	4,600.
Do.		Arab Company for White Cement Industry	Amman	130.
Feldspar		General Mining Company Ltd.	Al-Jaishiah	14.[e]
Gypsum		Al-Nisr/Ali Manaseer	Mujib	89.[e]
Do.		Jordan Cement Factories Company Ltd. (JCFC)	River Zarqa	73.[e]
Do.		Public Mining Company Ltd.	Mujib	68.[e]
Do.		Al-Nasr Mining Establishment	do.	31.[e]
Do.		Falahat Mining Establishment	do.	25.[e]
Do.		Shaker Al-Talib Establishment	Subeihi	15.[e]
Do.		Al-Noor Mining Company	Mujib	11.[e]
Kaolin		Jordanian Company for Mining and Processing of Kaolin and Feldspar	Qanasieh	150.[e]
Do.		Al-Faori Enterprise for Mining	Al-Adasieh	110.[e]
Do.		Public Mining Company Ltd.	Fuahais	38.[e]
Do.		do.	Batn el-Ghoul	31.[e]
Magnesia[2]		Jordan Magnesia Company (Arab Potash Company Ltd., 55.3%)	al-Safi	60.
Natural gas	million cubic meters	National Petroleum Company (Government, 100%)	Risha	460.
Petroleum:				
Crude	thousand 42-gallon barrels	National Petroleum Company	Hamza	NA.
Refined	do.	Jordan Petroleum Refinery Company (JPRC)	Zarqa	36,500.
Phosphate:				
Phosphate rock		Jordan Phosphate Mines Company (Brunei Investment Agency, 37%, and Government of Jordan, 26.9%)	Al-Abiad, Al-Hassa, and Eshidiya Mines	7,000.
Phosphatic fertilizers		Jordan Phosphate Mines Company	Aqaba	800 diammonium phosphate.
Do.		Nippon Jordan Fertilizer Company (Asahi Industries Company, Ltd., Mitsubishi Corp., Mitsubishi Kasei Corp., and Zen-Noh, 60%; Arab Potash Company Ltd., 20%, and Jordan Phosphate Mines Company, 20%)	Eshidiya	100 diammonium phosphate; 200 other.
Phosphoric acid[3]		Jordan Phosphate Mines Company	Aqaba	413.
Do.[3]		Indo-Jordan Chemicals Company (Southern Petrochemical Industries Corp. Ltd., 52.2%; Jordan Phosphate Mines Company 34.8%)	Eshidiya	225.
Potash		Arab Potash Company Ltd. (Potash Corp. of Saskatchewan, 28%; Government of Jordan, 26.9%; Arab Mining Co., 20.1%)	al-Safi	1,950.
Potassium nitrate		Kemira Arab Potash Company (Arab Potash Company Ltd., 50%, and Kemira Danmark A/S, 50%)	Aqaba	150.
Pozzolanic material		Jordan Cement Factories Company Ltd.	Tel Remah	340.[e]
Do.		do.	Rashahdieh	130.[e]
Sand, silica		Middle East Regional Development Enterprises	Ras al-Naqab	530.
Do.		Mahmoud Habahbeh and Sons Quarry	do.	28.[e]
Do.		Al-Rehab for Industrial Services and Trading	do.	27.[e]
Do.		Al-Fares for Silica Sand Mining	do.	17.[e]
Steel:				
Crude		Jordan Steel Company	Amman	300.
Semimanufactured		do.	do.	300.
Do.		National Steel Industry Co.	Awajan	100.
Do.		Other steel producers	NA	506.
Sulfuric acid		Jordan Phosphate Mines Company	Aqaba	1,450.
Do.		Indo-Jordan Chemicals Company	Eshidiya	660.

[e]Estimated. NA Not available.
[1]Estimates for feldspar, gypsum, kaolin, pozzolanic material, and silica sand producers are based on maximium production for 1 year between 2000 and 2005.
[2]Shut down in 2004.
[3]Expressed in phosphorus pentoxide (P_2O_5) equivalent.

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THE MINERAL INDUSTRY OF KUWAIT

By Philip M. Mobbs

Kuwait's economy revolved around the production and refining of hydrocarbons. The hydrocarbon sector accounted for about 94% of Government revenue. In 2006, total exports (free on board) were valued at $55 billion,[1] of which oil exports accounted for about $52.8 billion and manufactured fertilizer exports (ammonia, ammonium sulfate, sulfuric acid, and urea) accounted for $217 million. In 2005, the value of total exports was $45 billion, of which oil exports accounted for $42 billion and manufactured fertilizer exports accounted for $192 million. The continued increase in the international market price of crude oil accounted for a significant proportion of the increase in the value of Kuwaiti exports in 2006 compared with that of 2005. Total imports (cost, insurance, and freight paid to point of destination) in 2006 were estimated to be about $15.9 billion compared with a revised $15.8 billion in 2005 (Central Bank of Kuwait, 2007).

Production

Production of most mineral and mineral-based commodities in Kuwait was estimated to have increased in 2006. The most notable increase was in concrete-reinforcing steel bars (rebar), which was used in the booming regional construction industry. In November, refined petroleum products and sulfur were estimated to have decreased slightly because of the explosion and fire at the Shuaiba Refinery, which was owned by Kuwait National Petroleum Co. K.S.C. (KNPC).

Structure of the Mineral Industry

The Supreme Petroleum Council and the Ministry of Oil were the Government organizations that were responsible for the petroleum sector in Kuwait. Subsidiaries of state-owned Kuwait Petroleum Corp. dominated the country's crude oil, fertilizer, natural gas, and refined petroleum operations. The state-owned Kuwait Investment Authority held interests in Kuwaiti cement and steel pipe companies.

Commodity Review

Metals

Iron and Steel.—The 150,000-metric-ton-per-year (t/yr)-capacity Kuwait Reinforced Steel Manufacturing Co. began rebar production in August 2005. In September 2006, the company started an expansion program that would increase the plant's capacity to 400,000 t/yr (Ali Al-Sarraf International Group Co., undated).

Mineral Fuels

Natural Gas.—Most of Kuwaiti gas production was associated with crude oil production. In 2006, the announced discovery of nonassociated natural gas reserves of nearly 100 billion cubic meters at Sabriyah and Um-Niqa significantly expanded Kuwait's recoverable gas resources. Additional associated gas was reported from the Arifjan area. Kuwait Oil Co. K.S.C. awarded a 5-year operations contract for the development of the Sabriyah Field to Safwan Petroleum Technologies Co. of Kuwait. Safwan expected initial production to begin in late 2007 and anticipated that production from the field would reach 6 billion cubic meters per year by 2011, which would account for an addition of about 40% to Kuwait's daily natural gas production. The discovery of nonassociated natural gas decreased the urgency for the Ministry of Energy to quickly complete negotiations to import natural gas from other gas-producing countries (Kuwait Oil Co. K.S.C., 2006, p. 20; Middle East Economic Digest, 2006b).

Petroleum.—In 2006, progress on the proposed construction of a fourth crude oil refinery for KNPC was set back. Construction bids exceeded $15 billion for a 615,000-barrel-per-day-capacity refinery at Al-Zour; KNPC had estimated that the new refinery would cost about $6.3 billion. Much of the increased price was attributed to rising regional costs for construction inputs, such as cement, engineering services, labor, and steel. Additionally, Saudi Arabian Chevron Inc. (formerly Saudi Arabian Texaco Inc.), which produced hydrocarbons for Saudi Arabia from the Wafra Field in the Partitioned Neutral Zone between Kuwait and Saudi Arabia, objected to the location, citing a 1954 agreement that the proposed site of the refinery would be reserved for the use of the partitioned zone operator until 2009 when its concession expired. In 2006, Saudi Arabian Chevron had begun injecting steam into the Wafra Field's reservoir as a secondary recovery pilot project, had drilled an additional 50 wells in the field, and had requested an extension of the concession's term (James, 2005; Middle East Economic Digest, 2006a; 2007).

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[1]Where necessary, values have been converted from Kuwaiti dinars (KD) to U.S. dollars (US$) at the rate of KD0.291=US$1.00 for 2006 and KD0.292=US$1.00 for 2005.

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TABLE 1

KUWAIT: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2002	2003	2004	2005	2006
Cement		1,584,000 [4]	1,863,400	2,635,000 [4]	2,145,000 [r, 4]	2,200,000
Iron and steel:						
Crude		--	100,000	200,000	450,000	500,000
Rolled-steel bar		70,000	150,000	369,000	480,000	680,000
Lime, hydrated and quicklime		40,000	40,000	40,000	49,800 [4]	50,000
Natural gas:[5]						
Gross	million cubic meters	9,900	11,000	11,860	13,300	13,900
Dry	do.	8,100	9,100	9,800	11,000	11,500
Nitrogen:						
N content of ammonia		414,400 [4]	444,400 [4]	413,400 [4]	466,570 [4]	470,000
N content of urea		320,000	330,000	341,020 [4]	365,350 [4]	370,000
Petroleum:						
Crude[5]	thousand 42-gallon barrels	680,000	817,000	837,655 [4]	939,276	980,000
Natural gas liquids and liquefied petroleum gases[e]	do.	45,000	40,000	39,920 [4]	37,887	38,000
Refinery products:[6]						
Gasoline, motor	do.	11,000	12,000	16,878 [4]	23,830 [4]	22,000
Kerosene	do.	45,000	45,000	53,133 [4]	59,054 [4]	58,000
Distillate fuel oil	do.	84,000	85,000	90,000	95,000	93,000
Residual fuel oil	do.	54,000	55,000	60,000	65,000	64,000
Other	do.	83,000	86,000	86,000	70,000	68,000
Total	do.	277,000	283,000	300,000	313,000	305,000
Salt		42,500 [4]	44,700 [4]	45,000	50,000	50,000
Sulfur:						
Elemental, petroleum byproduct		634,000	714,000	682,000	700,000	650,000
Sulfuric acid		150,000	150,000	150,000	150,000	150,000

[r]Revised. -- Zero.

[1]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Table includes data available through August 6, 2007.

[3]In addition to commodities listed, secondary aluminum, chlorine, clays, petroleum coke, glass, steel reinforcing bar, and sand and gravel were produced, but available information is inadequate to make reliable estimates of output.

[4]Reported figure.

[5]Includes Kuwait's share of production from the Partitioned Neutral Zone.

[6]Excludes liquefied petroleum gases.

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TABLE 2
KUWAIT: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies (and major equity owners)	Location of main facilities	Annual capacity
Aluminum, secondary		Arabian Light Metals Co. K.S.C. (Kuwait Industries Co. Holding K.S.C.)	Ahmadi	NA
Cement:				
Clinker		Kuwait Cement Co. K.S.C. (Kuwait Investment Authority, 32%, and National Industries Group, 22.4%)	Kilns at Shuaiba	1,800,000
Grey portland		do.	Mills at Shuaiba	2,200,000
Do.		Hilal Cement Co. K.S.C.C.	Sulaibiya Industrial Area	(1)
Do.		Portland Cement Co. K.S.C.C.	Shuwaikh	(1)
White		Kuwait Cement Co. K.S.C. (Kuwait Investment Authority, 32%, and National Industries Group, 22.4%)	Kiln and mill at Shuaiba	115,000
Iron and steel, steel:				
Crude		Al Oula Steel Manufacturing Co.	Shuaiba	500,000
Rolled				
Bar and rod		United Steel Industrial Co. K.S.C.C. (Joint venture of local investors and Ahwaz Steel Commercial and Technical Services GmbH of Germany)	Rolling mill at Shuaiba	500,000 [2]
Do.		Kuwait Reinforced Steel Manufacturing Co. (Ali Al-Sarraf International Group Co.)	do.	150,000 [3]
Pipes		Kuwait Pipes Industries and Oil Services Co K.S.C.	Pipe mill at Sulaibiya Industrial Area	120,000
Do.		do.	Pipe mill at Shuwaikh	65,000
Do.		Khalid Ali Al-Kharafi & Brothers Co. W.L.L.	Pipe mill at Shuaiba	NA
Natural gas	million cubic meters	Various[4]	Various fields	14,000
Natural gas liquids		Kuwait Oil Co. K.S.C. (Kuwait Petroleum Corp., 100%)	do.	45,000 [5]
Nitrogen:				
Ammonia		Petrochemical Industries Co. K.S.C. (Kuwait Petroleum Corp., 100%)	Plant B, Shuaiba	657,000
Urea		do.	Plants A and B, Shuaiba	639,000
Petroleum:				
Coke, calcined		do.	Shuaiba	350,000 [6]
Crude	42-gallon barrels per day	Kuwait Oil Co. K.S.C. (Kuwait Petroleum Corp., 100%)	South and East Fields (Burgan, Khasman, and Madina Fields)	1,350,000
Do.	do.	Al-Khafji Joint Operations (Kuwait Gulf Oil Co., 50%, and Aramco Gulf Operations Co. of Saudi Arabia, 50%)	Khafji Field, offshore Partitioned Neutral Zone	600,000
Do.	do.	Kuwait Oil Co. K.S.C. (Kuwait Petroleum Corp., 100%)	North Fields (Abdali, Bahra, Ratga, Matraba, Raudhatain, and Sabiya Fields)	559,000
Do.	do.	do.	West Fields (Abdaliya, Kra' Al-Mero, Managish, and Umm Gudair Fields)	427,000
Do.	do.	do.	South Fuwairis and South Umm Gudair Fields, Partitioned Neutral Zone	80,000
Do.	do.	Kuwait Oil Co. K.S.C. (Kuwait Petroleum Corp., 100%) and Saudi Arabian Texaco Inc. (Chevron Corp., 100%)	Wafra Field, onshore Partitioned Neutral Zone	80,000
Do.	do.	Kuwait Gulf Oil Co. (Kuwait Petroleum Corp., 100%)	Hout Field, offshore Partitioned Neutral Zone	NA
Refined products	do.	Kuwait National Petroleum Co. K.S.C. (Kuwait Petroleum Corp., 100%)	Mina Al-Ahmadi Refinery	415,000
Do.	do.	do.	Mina Abdulla Refinery	240,000
Do.	do.	do.	Shuaiba Refinery	195,000

See footnotes at end of the table.

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TABLE 2--Continued
KUWAIT: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity	Major operating companies (and major equity owners)	Location of main facilities	Annual capacity
Salt	Salt and Chlorine Factory (Al Ahlia Industrial Projects Co., 43.16%)	Shuaiba	NA
Sulfur	Kuwait National Petroleum Co. K.S.C. (Kuwait Petroleum Corp., 100%)	Mina Abdulla, Mina Al-Ahmadi, and Shuaiba Refineries	NA
Do.	Petrochemical Industries Co. K.S.C. (Kuwait Petroleum Corp., 100%)	Plants A and B, Shuaiba	1,320,000

NA Not available.
[1]Marketed imported bulk cement.
[2]Nominal design capacity. Actual production exceeded design capacity in 2006.
[3]Expansion of plant production capacity to 400,000 metric tons per year was underway. Completion expected in 2007.
[4]Some natural gas is produced and recovered from most crude oil production operations in Kuwait and the Partitioned Neutral Zone.
[5]Includes refinery-produced liquefied petroleum gases.
[6]Under construction.

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THE MINERAL INDUSTRY OF LEBANON

By Thomas R. Yager

Lebanon did not play a significant role in the world's production or consumption of minerals in 2006. Cement production and rock and sand quarrying were the mineral production and processing activities that were of the greatest significance to the Lebanese economy.

Production

Lebanon's cement production increased considerably from 2002 to 2006; domestic cement consumption totaled more than 3.3 million metric tons (Mt) in 2006 compared with 2.5 Mt in 2002. Exports to Iraq and Syria also increased. The increase in cement production led to higher output of limestone for use in cement (Cimenterie Nationale S.A.L., 2007).

Structure of the Mineral Industry

Lebanon's four cement plants and its phosphatic fertilizers, phosphoric acid, and sulfuric acid plants were privately owned. The country was also estimated to have between 300 and 400 rock and sand quarries, many of which were unlicensed (Bathish and Zeineddine, 2007).

Commodity Review

Industrial Minerals

Cement.—Ciment de Sibline S.A.L., Cimenterie Nationale S.A.L., Holcim (Liban) S.A.L., and Seament S.A.L. produced cement at a rate of 5 million metric tons per year (Mt/yr) in 2006; the combined capacity of their plants was about 6 Mt/yr. Holcim (Liban) produced about 2 Mt/yr of cement, and Cimenterie Nationale, about 1.7 Mt/yr. Cement demand declined in the fourth quarter of 2006 because of fighting in Lebanon between Israel and the Hezbollah organization; demand for the entire year, however, still increased. Post-combat reconstruction was expected to consume 700,000 metric tons to 1 Mt during the next 2 to 3 years. In August, Lebanon's cement producers agreed to a 1-year price ceiling of $65 per metric ton to aid reconstruction efforts; the price differential between Lebanon and Syria led to the smuggling of cement to Syria (Bluhm, 2006; Cimenterie Nationale S.A.L., 2007).

Mineral Fuels

Natural Gas.—In March 2005, a natural gas pipeline that linked Lebanon with Syria was completed. Delivery of natural gas to Lebanon was planned to begin in early May 2005, but was delayed until 2007 because of political conflicts and insufficient Syrian production. The development of the Palmyra Middle Gas Energy Project in Syria was expected to provide enough natural gas to supply Lebanese markets. Lebanon was expected to import about 550 million cubic meters of natural gas from Syria initially; imports could increase eventually to nearly 2.2 billion cubic meters per year (Rasmussen, 2005; United Press International, 2006).

Petroleum.—Lebanon has no petroleum reserves, and the Zahrani and the Tripoli refineries were shut down in 1989 and 1992, respectively. In January and April 2006, the Government signed memorandums of understanding with Qatar Petroleum International (QPI) to develop a new petroleum refinery with a capacity of between 150,000 and 200,000 barrels per day. In October, QPI completed a feasibility study of the refinery, which was expected to be completed in 2011 at a cost of about $1 billion (Middle East Economic Digest, 2006; Quinlan, 2006).

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TABLE 1
LEBANON: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004	2005[e]	2006[e]
Cement, hydraulic	thousand metric tons	2,852	3,500 [e]	4,500 [r,e]	4,500	5,000
Gypsum[e]		30,000 [r]	30,000 [r]	30,000 [r]	30,000 [r]	30,000
Lime[e]		14,000	14,000	14,000	14,000	14,000
Limestone, for cement[e]	thousand metric tons	3,700	4,600	5,900	5,900	6,500
Phosphate:[3]						
Phosphatic fertilizers		30,000	53,000	85,000	85,000	85,000
Phosphoric acid		150,000	166,000	175,000	180,000	180,000
Salt[e]		3,500	3,500	3,500	3,500	3,500
Steel, semimanufactured		40,000 [e]	--	--	--	--
Sulfuric acid:						
Gross weight		480,000	485,000	495,000	500,000	500,000
S content		157,000	159,000	162,000	164,000	164,000

[e]Estimated; estimated data are rounded to no more than three significant digits. [r]Revised. -- Zero.

[1]Table includes data available through June 29, 2007.

[2]In addition to the commodities listed, sand and gravel and other construction materials are also produced, but quantities are not reported, and available information is inadequate to make reliable estimates of output.

[3]P_2O_5 equivalent.

TABLE 2
LEBANON: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity
Aggregates		Holcim (Liban) S.A.L. (Holcim Ltd., 52%)	Beirut	NA
Cement		do.	Chekka	2,200
Do.		Cimenterie Nationale S.A.L.	do.	1,650
Do.		Ciment de Sibline S.A.L.	Sibline	1,200
Do.		Seament S.A.L.	Chekka	500
Gypsum		NA	Hosrayel	30
Lime		Seament S.A.L.	Chekka	NA
Petroleum, refined	thousand 42-gallon barrels	Ministry of Industry and Petroleum[1] (Government, 100%)	Tripoli	12,800
Do.		do.[2]	Zahrani	6,400
Phosphate fertilizers		Lebanon Chemicals Company S.A.L.	Selaata	NA
Phosphoric acid		do.	do.	NA
Steel		Consolidated Steel Lebanon S.A.L.[3]	Amchit	300
Sulfuric acid		Lebanon Chemicals Company S.A.L.	Selaata	NA

NA Not available.

[1]Shut down in 1992.

[2]Shut down in 1989.

[3]Shut down in 2002.

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The Mineral Industry of Oman

By Philip M. Mobbs

The economy of the Sultanate of Oman was based on the production and processing of hydrocarbons. Oman was the seventh ranked crude oil producer in the Middle East and accounted for about 0.9% of total world crude oil production (BP p.l.c., 2007, p. 8).

In 2006, total merchandise exports were valued at more than $21.5 billion, of which crude oil accounted for $14.3 billion; liquefied natural gas, $3 billion; base metals and articles manufactured from base metals, $320 million; refined petroleum products, about $123 million; and other mineral products, about $560 million. The value of total recorded imports was $11 billion, of which mineral fuels accounted for $361 million and crude minerals, $319 million (Central Bank of Oman, 2007, p. 102, 105, 108).

Minerals in the National Economy

The Government's potential loss of revenue from the 5% decline in crude oil production in 2006 was offset by the average price received for Omani oil, which increased to $61.69[1] per barrel compared with $50.26 per barrel in 2005. Total Government revenues were $13 billion in 2006; revenue from hydrocarbons increased to more than $9.9 billion, of which crude oil accounted for $8.4 billion, and natural gas, $1.5 billion (Central Bank of Oman, 2007, p. 42, 51).

Production

Notable increases in Omani mineral production in 2006 compared with that of 2005 included that of chromite, which increased by 97%; silver, by 80%; ammonia, by an estimated 61%; sulfur, by an estimated 33%; and natural gas, by 24%. Gold production declined by 63% in 2006 compared with 2005; and crude petroleum, by 5%. The near doubling of national chromite output was attributed to the opening of new chromite pits by Gulf Mining and Materials Co. The increase in silver production and the decrease in gold production were attributed to changes in output of the Sohar and the Yankul Mines of Oman Mining Co. L.L.C. A full year of production at the plant of Oman India Fertilizer Co. S.A.O.C., which began production in July 2005, accounted for the estimated increase in ammonia and urea output. The increased sulfur production was attributed to the estimated output from the new Sohar oil refinery, and the drop in crude oil output was a continuation of the long-term decline of production from older oilfields (Central Bank of Oman, 2007, p. 44, 46; Gulf Mining and Materials Co., undated).

[1]Where necessary, values have been converted from Omani rials (RO) to U.S. dollars (US$) at the average rate of RO0.386=US$1.00.

Structure of the Mineral Industry

The Ministry of Commerce and Industry regulated the mining sector in accordance with the Mining Law, Royal Decree No. 27/2003. Private mineral sector operations that were started in 2006 included the Wadi Mahram-area chromite mines and the Barka-area construction material (laterite) mine of Gulf Mining and Materials Co.

The Ministry of Oil and Gas managed the petroleum sector. Petroleum Development Oman (PDO), which was 60% state-owned, produced about 90% of the country's crude oil. In 2006, state-owned Sohar Refinery Co. L.L.C., which had been designed to export most of its output, began refining petroleum products, and the Qalhat LNG S.A.O.C. plant started production of liquefied natural gas (LNG).

Outlook

Several significant mineral-sector projects are underway in Oman. The completion of the construction of the 350,000-metric-ton-per-year (t/yr)-capacity Sohar Aluminum smelter is expected in 2008. Startup of National Mining Co. L.L.C.'s 20,000-t/yr-capacity Lasail concentrator, which would process copper ore from the Ajib copper mine, was expected in 2007. Initial output from the 1.5-million-metric-ton-per-year (Mt/yr)-capacity direct-reduced iron plant and the 720,000-t/yr-capacity steel plant at Sohar, which is owned by Shadeed Iron & Steel L.L.C. (a subsidiary of Al-Ghaith Holding PJSC of the United Arab Emirates), is expected in 2008. Companhia Vale do Rio Doce of Brazil is evaluating the construction of a 7.5-Mt/yr-capacity iron-ore-pellet plant at Sohar (Middle East Economic Digest, 2006c, d; Midrex Technologies, Inc., 2006; National Mining Co. L.L.C., 2006).

The planned commissioning of Raysut Cement Co.'s production line IV in 2007 would increase the plant's nameplate cement production capacity to about 1.8 Mt/yr, although in recent years, the plant has produced at 120% to 130% of design capacity. In 2007, commercial operations are expected to begin at Sohar International Urea and Chemical Industries S.A.O.C.'s 2,000-metric-ton-per-day (t/d) ammonia and 3,500-t/d granular urea plant at Sohar and at Oman Methanol Co.'s 3,000-t/d-capacity methanol plant. PVAXX Ltd. of Bermuda planned to use regionally produced silica sand and polyethylene at its proposed shipping pallet plant at Sohar (KHD Humboldt Wedag, 2006; Middle East Economic Digest, 2006b; Omani Center for Investment Promotion and Export Development, The, 2006).

Several enhanced-oil-recovery projects are underway or under evaluation. PDO's Harweel project's miscible gas flood at the Zalzala Field, the polymer-flood program at the Marmul Field, and the steam injection programs at the Fahud and the Qarn Alam Fields are designed to increase crude oil production from the oilfields, as is Occidental Mukhaizna L.L.C.'s steam flood of the Mukhaizna Field.

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The crude oil refining capacity expansion of the Oman Refinery Co. L.L.C. to 106,000 bbl/d from 85,000 bbl/d is expected to be completed by 2007. The Government also proposed to build a 250,000-barrel-per-day-capacity crude oil refinery at Duqm (Middle East Economic Digest, 2006a; Oman Refinery Co. L.L.C., 2007).

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TABLE 1
OMAN: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004	2005	2006[p]
Cement, hydraulic[e]		1,700,000	2,100,000	2,500,000	2,600,000 [r]	2,600,000
Chromium, gross weight		27,444	13,800 [r]	18,575	34,000 [r]	67,000
Copper, metal:						
Smelter		25,000	18,000	16,000 [r]	25,000	25,000 [e]
Refinery		24,000	17,040 [r]	15,090 [r]	24,543 [r]	24,500 [e]
Gas, natural:						
Gross	million cubic meters	22,366	24,128	24,150	23,998	29,783
Dry[e]	do.	14,800	17,000	17,000	17,390 [r,3]	21,754 [3]
Gold	kilograms	188	31 [r]	211 [r]	384 [r]	144
Gypsum		55,722	181,900 [r]	103,000 [r]	133,100 [r]	130,000
Iron and steel, crude steel[e]		60,000	80,000	84,000 [r]	84,000 [r]	84,000
Natural gas liquids[e]	thousand 42-gallon barrels	6,000	6,000	6,000	6,000	7,000
Nitrogen:						
N content of ammonia		--	--	--	620,000	1,000,000
N content of urea		--	--	--	320,000	830,000
Petroleum:						
Crude and condensate	thousand 42-gallon barrels	328,000 [e]	300,000 [e]	285,385	282,616	269,242
Refinery products:[4]						
Liquefied petroleum gas	do.	545 [e]	550 [e]	473	580	630
Gasoline	do.	5,428	5,400 [e]	5,215	5,436	5,078
Jet fuel and kerosene	do.	2,008	2,000 [e]	1,407	1,770	2,339
Distillate fuel oil	do.	6,658	6,700 [e]	6,442	7,089	6,750
Residual fuel oil	do.	14,942	15,000 [e]	14,247	15,445	14,947
Other	do.	1,048	1,000 [e]	1,162	1,253	1,283
Total	do.	30,629	30,700 [e]	28,946	31,573	31,027
Salt		14,410	12,300 [r]	12,400 [r]	10,900 [r]	11,000
Sand and gravel[e]		21,736,414 [3]	22,000,000	23,000,000	24,000,000	25,000,000
Silver	kilograms	38	9 [r]	89 [r]	122 [r]	220
Stone:						
Marble		135,930 [3]	146,600 [r]	163,800 [r]	220,900 [r]	220,000
Other[e]		3,182,522 [3]	3,200,000	3,500,000	3,600,000	3,600,000
Sulfur[e]		30,000	30,000	30,000	30,000	40,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [p]Preliminary. [r]Revised. -- Zero.

[1]Table includes data available through October 18, 2007.

[2]In addition to the commodities listed, chlorine products, clay for bricks and tile, and laterite for construction were produced, but available information is inadequate to make estimates of output.

[3]Reported figure.

[4]Official production data does not include production from the Sohar refinery, which began operations in 2006.

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TABLE 2
OMAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Oman Cement Co. S.A.O.G.	Kilns and mills at Rusayl	1,200,000
Do.		Raysut Cement Co.	Kilns and mills at Salalah	1,100,000
Chromite		Oman Chromite Co. S.A.O.G.	Mines near Sohar	29,000
Do.		Gulf Mining and Materials Co.	Wadi Mahram area	NA
Copper				
Ore		National Mining Co. L.L.C. (MB Holding Co. L.L.C.)	Open pit mines at Ajib and Shinas	20,000
Refined metal		Oman Mining Co. L.L.C.	Lasail, near Sohar	25,000
Gold	kilograms	do.	Sohar and Yankul	400
Iron and Steel				
Crude steel		Modern Steel Mills L..L.C. (Oman International Development and Industrial Co. S.A.O.G.; Assarain Group of Companies, Dharamsey Group, and others)	Rusayl	84,000
Rolled steel products (rebar)		Sharq Sohar Steel Rolling Mills L.L.C.	Sohar	250,000
Do.		Hadid Majan L.L.C.	Bait Al Falaj	100,000
Rolled steel products (tubes)		Al Jazeera Tube Mills Co. S.A.O.G.	Sohar	NA
Marble		Companies that quarried marble included Al Ajmi Marble Co., Al Madinah Marble Co., Al Nasser Marble Co., Al Rushaidi Marble Co., Al Shanfri Marble Co., Al Zarabi Marble Co., International Marble, and Omani Marble Co.	Quarries primarily located in the Wilayat of Ibri	NA
Natural gas	million cubic meters	Petroleum Development Oman L.L.C. [Government, 60%; Royal Dutch Shell p.l.c., 34%; Private Oil Holdings Oman Ltd., 4%; Partex (Oman) Corp., 2%]	Gasfields and oilfields with associated natural gas in the Kauther/Yibal, the Saih Niyahda, and the Saih Rawl clusters	27,000
Natural gas, liquefied		Oman Liquefied Natural Gas L.L.C. [Government, 51%; Royal Dutch Shell plc, 30%; Total S.A., 5.54%; Korea LNG, 5%, Mitsubishi Corp., 2.77%, Mitsui E&P Middle East B.V., 2.77%; Partex (Oman) Corp., 2%; Itochu Corp., 0.92%]	Two trains at Qalhat	6,600,000
Do.	do.	Qalhat Liquefied Natural Gas S.A.O.C. (Government, 55.84%; Oman Liquefied Natural Gas L.L.C., 36.8%; Union Fenosa S.A., 7.36%)	One train at Qalhat	3,300,000
Petroleum:				
Crude	barrels per day	Petroleum Development Oman L.L.C. [Government, 60%; Royal Dutch Shell p.l.c., 34%; Private Oil Holdings Oman Ltd., 4%; Partex (Oman) Corp., 2%]	About 100 oilfields in the Bahja, the Fahud, the Harweel, the Lekhwair, the Marmul, the Nimr, the Qarn Alam, and the Yibal clusters	900,000
Do.	do.	Oxy Oman, Inc (Occidental Petroleum Corp., 65%, and Mitsui E&P Middle East B.V., 35%)	Blocks 9 and 27, includes the Safah and Al Sunienah Fields	55,000
Do.	do.	Daleel Petroleum Co. L.L.C. (Mazoon Petrogas S.A.O.C., 50%, and Mazoon Petrogas B.V.I., 50%)	Block 5	16,000
Do.	do.	Occidental Mukhaizna, L.L.C. [Occidental Petroleum Corp., 45%; Oman Oil Corp. S.A.O.C., 20%; Shell Oman Trading Co. Ltd., 17%; Liwa Energy Ltd., 15%; Total Exploration and Production Oman, 2%; Partex (Oman) Corp., 1%]	Block 53, Mukhaizna Field	8,500
Do.	do.	Petrogas E&P L.L.C. (MB Holding Co. L.L.C., 100%)	Block 5	2,000
Do.	do.	Partnership of Indago Oman Ltd., 40% (operator); LG International Corp., 50%; Eagle Energy (Oman) Ltd., 10%	Block 8, Bukha Field	1,100

See footnotes at end of table.

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TABLE 2--Continued
OMAN: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petroleum--Continued:				
Refined	million barrels per year	Sohar Refinery Co. L.L.C. (Ministry of Finance, 80%, and Oman Oil Co. S.A.O.C., 20%)	Sohar	41
Do.	do.	Oman Refinery Co. L.L.C. (Ministry of Oil and Gas of Oman, 99%)	Mina Al-Fahal	30 [1]
Salt, crude, industrial		Modern Salt Co. L.L.C.	Wilayat of Ibri	NA
Silver	kilograms	Oman Mining Co. L.L.C.	Sohar and Yankul	300

NA Not available.

[1]Expansion project to increase processing capacity to 37,000,000 barrels per year (106,000 barrels per day) was expected to be completed in 2007.

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The Mineral Industry of Qatar

By Philip M. Mobbs

The mineral output of Qatar was dominated by hydrocarbons. In 2006, the natural gas and crude petroleum sector accounted for about 81% of total merchandise exports, about 67% of Government revenue, and about 62% of the gross domestic product (GDP). The manufacturing sector, which included the production of cement, fertilizers, and steel, and the refining of petroleum, accounted for an additional 7% of the GDP (Qatar Central Bank, 2007, p. 48, 54, 62).

In October, Qatar Petroleum announced that the moratorium on additional development of the gas reservoirs of the North Field between 2005 and 2007 would be extended to 2010. Domestic use of natural gas would have priority over natural gas export projects when the moratorium was lifted (Middle East Economic Digest, 2006a).

Production

In 2006, the large increase in the production of helium was attributed to the Ras Laffan Helium Plant ramping up to full production. Crude helium was extracted at the country's seven liquefied natural gas (LNG) trains and subsequently purified and liquefied. Besides hydrocarbons, other notable minerals and mineral-based commodities produced in Qatar included cement, crude steel, direct-reduced iron (DRI), and nitrogenous fertilizer (ammonia and urea).

Structure of the Mineral Industry

The Government held direct or indirect interest in much of the country's mineral industry. Qatar Petroleum was a 100% state-owned company. Qatar Petroleum held majority interest in Industries Qatar Q.S.C., Qatar Liquefied Gas Co. Ltd. (Qatargas), Ras Laffan Liquefied Natural Gas Co. Ltd. (I) (RasGas I), and Ras Laffan Liquefied Natural Gas Co. Ltd. (II) (RasGas II). Industries Qatar held majority interest in Qatar Fertilizer Co. S.A.Q., Qatar Fuel Additives Co. Ltd. Q.S.C., and Qatar Steel Co. Q.S.C. (QASCO).

Commodity Review

Metals

Iron and Steel.—In 2006, QASCO continued its expansion program. Projects expected to be commissioned in 2007 included a hot-discharge combination DRI and hot-briquetted iron plant, an additional electric-arc furnace and continuous-casting facility, and a 700,000-metric-ton-per-year-capacity reinforcing-bar rolling mill (Qatar Steel Co. Q.S.C., 2007, p. 26-27).

Mineral Fuels

Natural Gas.—Numerous projects were planned for Qatar, but construction costs continued to spiral upward in 2006. The estimated cost of the 140,000-barrel-per-day (bbl/d)-capacity Pearl natural gas-to-liquid (GTL) plant rose to $16 billion in early 2007 from $12 billion in mid-2006, and about $5 billion in 2004. Other GTL projects in Qatar included the 34,000-bbl/d-capacity Oryx GTL plant, which was expected to come onstream in early 2007; the proposed 65,000-bbl/d capacity expansion of the Oryx plant; and the proposed 154,000-bbl/d-capacity Barzan GTL plant (Dutta, 2006; Middle East Economic Digest, 2006b; Hindley, 2007).

Ras Gas II initiated production from the 4.7-million-metric-ton-per-year (Mt/yr)-capacity LNG train 5 in November 2006. Ras Laffan Liquefied Natural Gas Co. Ltd. (III) expected that initial production from the 7.8-Mt/yr-capacity LNG train 6 would start in 2008, and completion of the construction of the 7.8-Mt/yr-capacity LNG train 7 was expected in 2009. Qatargas had four additional LNG trains under construction. Production from the 15.8-Mt/yr-capacity two LNG train Qatargas 2 plant was expected to begin in 2008. Construction of the 7.8-Mt/yr-capacity LNG train 6 of the Qatargas 3 project was expected to be completed in 2009, and of the 7.8-Mt/yr-capacity LNG train 7 of the Qatargas 4 project, in 2010 (Forbes, 2007; RasGas Co. Ltd., 2007).

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TABLE I

QATAR: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2002	2003	2004	2005	2006
Cement, hydraulic		1,340,000	1,400,000	1,400,000	1,400,000	1,400,000
Gas, natural:						
Gross	million cubic meters	39,000	40,000	50,000	59,000 r	63,000
Dry	do.	29,300	31,400	39,200	45,800 r	49,500
Helium		--	--	--	500,000	2,500,000
Iron and steel:						
Direct-reduced iron		750,000	780,000	830,359 r, 4	815,382 r, 4	876,885 4
Steel, crude		1,027,000 4	1,054,000 4	1,089,000 4	1,057,000 4	1,039,138 4
Semimanufactures:						
Billet		275,000	300,000	300,000	200,000 r	300,000
Bars		741,000 4	747,000 4	782,000 4	791,000 r, 4	729,916 4
Natural gas liquids	thousand 42-gallon barrels	27,000	60,000	75,000	100,000	100,000
Nitrogen:						
N content of ammonia		1,166,100 4	1,185,300 4	1,428,000 4	1,753,984 r, 4	1,800,000
N content of urea		798,700 4	800,000	1,040,000 4	1,388,121 r, 4	1,350,000
Petroleum:						
Crude	thousand 42-gallon barrels	230,000	260,000 r	270,000 r	280,000 r	290,000
Refinery products:						
Gasoline	do.	4,020	14,900	15,000	16,500 r	16,500
Kerosene	do.	2,450	7,370	7,500 r	8,000 r	8,000
Distillate fuel oil	do.	4,340	7,370	7,500 r	8,000 r	8,000
Residual fuel oil	do.	2,850	2,880	2,800	2,400 r	2,400
Other	do.	2,100	70,000 r	70,000 r	80,000 r	80,000
Total	do.	15,800	103,000 r	103,000 r	115,000 r	115,000
Stone, limestone		900,000	950,000	1,000,000	1,000,000	1,100,000
Sulfur		250,000	300,000	360,000	360,000	250,000

rRevised. -- Zero.

[1]Estimated data are rounded to no more than three significant digits; may not add to totals shown.

[2]Table includes data available through August 31, 2007.

[3]In addition to the commodities listed, clays, dolomite, gypsum, lime, sand and gravel, shale for construction purposes, and methanol are produced, but available information is inadequate to make estimates of output.

[4]Reported figure.

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TABLE 2
QATAR: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement:				
Portland		Qatar National Cement Co. (Government, 43%)	Kilns and mills at Umm Bab	1,400
Do.		Al-Jabor Cement Industries Co.	Clinker grinding mill at Mesaieed	165
White		Qatari Saudi Company for Industrial Transformation	do.	165
Helium		Joint venture of Qatar Liquefied Gas Co. Ltd., Ras Laffan Liquefied Natural Gas Co. Ltd., and Ras Laffan Liquefied Natural Gas Co. Ltd. (II)	Ras Laffan	2,800
Iron and steel:				
Iron, direct reduction		Qatar Steel Co. Q.S.C. (Industries Qatar Q.S.C., 100%)	Mesaieed	830 [1]
Steel, crude		do.	Plant at Mesaieed	1,200
Steel, rolled		do.	Rolling mill at Mesaieed	740
Lime		Qatar National Cement Co. (Government, 43%)	Kilns at Umm Bab	28
Methanol		Qatar Fuel Additives Co. Ltd. Q.S.C. (Industries Qatar Q.S.C., 50%; OPIC Netherlands Antilles N.V., 20%; Lee Chang Yung Chemical Industry Corp., 15%; International Octane Ltd., 15%)	Mesaieed	825
Natural gas:				
Extracted	billion cubic meters	Qatar Liquefied Gas Co. Ltd. (Qatar Petroleum, 65%; Total S.A., 20%; ExxonMobil Qatargas Inc., 10%; Mitsui & Co., Ltd., 2.5%; Marubeni Corp., 2.5%)	North Field, offshore	20
Do.	do.	Ras Laffan Liquefied Natural Gas Co. Ltd. (I) (Qatar Petroleum, 63%; ExxonMobil Rasgas, Inc., 25%; Korea Gas Corp., 5%; Itochu Corp., 4%; LNG Japan Corp., 3%)	do.	11
Do.	do.	Qatar Petroleum (Government, 100%)	do.	1
Liquefied		Qatar Liquefied Gas Co. Ltd. (Qatar Petroleum, 65%; Total S.A., 10%; ExxonMobil Qatargas Inc., 10%; Mitsui & Co., Ltd., 7.5%; Marubeni Corp., 7.5%)	Three trains at Ras Laffan	10,200
Do.		Ras Laffan Liquefied Natural Gas Co. Ltd. (I) (Qatar Petroleum, 63%; ExxonMobil Rasgas, Inc., 25%; Korea Gas Corp., 5%; Itochu Corp., 4%; LNG Japan Corp., 3%)	Two trains at Ras Laffan	6,600
Do.		Ras Laffan Liquefied Natural Gas Co. Ltd. (II) (Qatar Petroleum, 70%, and ExxonMobil Rasgas, Inc., 30%)	Three trains at Ras Laffan	14,300
Nitrogen:				
Ammonia		Qatar Fertilizer Co. S.A.Q. (Industries Qatar Q.S.C., 75%; Yara Nederland BV, 15%; Fertilizer Holdings AS, 10%)	QAFCO 1, Mesaieed	420
Do.		do.	QAFCO 2, Mesaieed	440
Do.		do.	QAFCO 3, Mesaieed	650
Do.		do.	QAFCO 4, Mesaieed	740
Urea		do.	QAFCO 1, Mesaieed	470
Do.		do.	QAFCO 2, Mesaieed	530
Do.		do.	QAFCO 3, Mesaieed	890
Do.		do.	QAFCO 4, Mesaieed	1,300
Petroleum:				
Crude	thousand 42 -gallon barrels	Qatar Petroleum (Government, 100%)	Dukhan Field, onshore	100,000
Do.	do.	Maersk Oil Qatar A.S., operator[2]	Al Shaheen Field, offshore	90,000
Do.	do.	Occidental Petroleum of Qatar Ltd., operator[2]	Idd Al Sharqi, North Dome and South Dome	39,000
Do.	do.	Qatar Petroleum (Government, 100%)	Bul Hanine Field, offshore	21,000
Do.	do.	Total S.A., operator[2]	Al Khaleej, offshore	15,000
Do.	do.	do.	Maydan Mahzam Field, offshore	13,000
Do.	do.	Bunduq Co., Ltd. (BP Exploration, 33.3%; Total S.A., 33.3%; United Petroleum Development Co., 33.3%), operator[2]	El Bunduq[3]	5,300

See footnotes at end of table.

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TABLE 2--Continued
QATAR: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Petroleum--continued:				
Crude	thousand 42 -gallon barrels	Anadarko Petroleum Corp., 92.5%, operator[2]	Al Rayyan, offshore	5,000
Do.	do.	Qatar Petroleum Development Co. (Cosmo Oil Co., Nissho Iwai Corp., and United Petroleum Development Co.), operator[2]	Al Karkara and A Structure	2,000
Refined	do.	Qatar Petroleum (Government, 100%)	Mesaieed	115,000
Sulfur		Ras Laffan Liquefied Natural Gas Co. Ltd.	Ras Laffan	110
Do.		Qatar Petroleum (Government, 100%)	Mesaieed	95
Do.		Qatar Petrochemical Co. Ltd.	Umm Said	70
Do.		Qatar Liquefied Gas Co. Ltd.	Ras Laffan	66

[1]Design capacity is 400,000 metric tons per year; actual production is significantly higher.
[2]Operated under a development and production-sharing agreement with Qatar Petroleum.
[3]El Bunduq Field is located on the border between Qatar and the United Arab Emirates. Royalties are shared by the Governments.

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The Mineral Industry of Saudi Arabia

By Philip M. Mobbs

The Kingdom of Saudi Arabia continued to diversify its economy and mineral industry, although the nation's economy remained strongly linked to hydrocarbon production, which accounted for about 55% of the gross domestic product (GDP) at current prices in 2006. The 2005 and 2006 increase in the hydrocarbon sector's contribution to the GDP was attributable to the continued rise in international oil prices. Depending on the source of provisional 2006 crude oil production data, Saudi Arabia either maintained its position as the leading oil producer in the world or was ranked second, after Russia (BP p.l.c., 2007, p. 8; Saudi Arabian Monetary Agency, 2007, p. 116, 144; U.S. Energy Information Administration, 2007b).

All mineral deposits were the exclusive property of the state. The Ministry of Petroleum and Mineral Resources implemented general policy related to minerals, natural gas, and oil. Mining was regulated by Royal Decree No. M/47 (the Mineral Investment Law) of 20 Sha'ban 1425 (October 4, 2004).

Minerals in the National Economy

In addition to their contribution to the GDP, revenues associated with hydrocarbons accounted for a significant segment of Government income and national exports. Oil, along with natural gas and refined petroleum products, have formed a base for the establishment of other industries, including energy-intensive heavy industries and petrochemicals.

In 2006, the mining and quarrying sector accounted for about 0.2% of the GDP. The mining, quarrying, and natural gas and crude oil production sectors employed 1.5% of the country's labor force of about 5.6 million. The building and construction sector employed 37% of the labor force (Saudi Arabian Monetary Agency, 2007, p. 220, 331).

The hydrocarbon sector dominated Saudi Arabian exports. Despite the slight decline in crude oil production in 2006, the estimated value of crude oil exports was $160 billion, which was a 17% increase compared with that of 2005. The increase in crude oil export value was attributable to the increase in the average price of crude oil. The average price of the Arabian Light standard-type crude oil increased to $61.05 in 2006 compared with $50.15 in 2005 (a 21.7% increase). Crude oil exports accounted for 76% of the value of total exports in 2006; refined petroleum products, 14%; petrochemicals, 5%; and construction materials, 1%. Crude oil export volumes declined slightly in 2006 to about 2.57 billion barrels compared with 2.63 billion barrels in 2005. Exports of refined petroleum products and gas in 2006 totaled 59.9 million metric tons (Mt); chemical products, 18.1 Mt; and construction materials and steel, 10.4 Mt (Saudi Arabian Monetary Agency, 2007, p. 124-125, 132, 144, 350).

Production

Significant increases in output in 2006 were posted for barite, gypsum, iron ore (for cement), nitrogen (ammonia and urea), industrial (construction) and silica sand, and most types of stone. Slight, but notable, production declines were posted for crude oil and refined petroleum. The crude oil decline was attributed to a cut in the Organization of the Petroleum Exporting Countries' crude oil production ceiling allocation for Saudi Arabia. Data on mineral production are provided in table 1.

Structure of the Mineral Industry

The Government maintained ownership interest in most large companies that operated in the mineral sector. The Ministry of Petroleum and Mineral Resources supervised its affiliate companies in the fields of petroleum and minerals; these included Aramco Gulf Operation Ltd., Saudi Arabian Mining Co. (Ma'aden), Saudi Arabian Oil Co. (Saudi Aramco), and Saudi Texaco. The Ministry also supervised the Saudi Geological Survey. Subsidiaries of Saudi Basic Industries Corp., in which the Government held 70% interest and the private sector held 30% interest, included Jubail Fertilizer Co., National Chemical Fertilizer Co., Saudi Arabian Fertilizer Co., Saudi Iron and Steel Co., and several petrochemical companies.

Government plans to sell a 40% equity interest in Ma'aden were ongoing; the initial public offering was expected by late 2007. The Government would retain a 50% interest in Ma'aden, and the social security fund and the public pension agency would each be allowed to purchase up to 5% of Ma'aden's shares.

Privatization of the Saudi Railways Organization was underway, as was the second phase of privatization of management contracts at several docks, terminals, and wharfs of the Saudi Ports Authority. The Government also planned to divest some of its interest in joint-stock companies and reviewed the potential sale of its interest in joint-venture companies that had been formed with Arab and Islamic public investment companies.

Commodity Review

Metals

Aluminum.—In 2006, Ma'aden continued discussions with potential joint-venture investors concerning the development of a bauxite mine at Az Zabirah and an alumina refinery and an aluminum smelter at Ras al-Zour. Western Way for Industrial Development Co. of Saudi Arabia proposed to build an alumina refinery and aluminum smelter complex in Jizan Economic City on the Red Sea. Bauxite feed for the Jizan alumina facility was to be imported from Greece.

Copper, Gold, Silver, and Zinc.—Ma'aden continued the development of Al Amar Mine, which was located about 210 kilometers (km) west of Riyadh, and work on the Ad Duwayhi deposit, which was located about 400 km east of Jeddah. Startup of Al Amar Mine was expected in late 2007, and annual

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production was anticipated to be about 6,500 metric tons (t) of zinc, 1,100 t of copper, and 2 t of gold and silver. Gold and silver doré was to be refined by L'Azurde Group for Industrial Investment of Saudi Arabia; copper and zinc concentrates from Al Amar Mine were to be exported for processing. Initial output from the Ad Duwayhi project was expected in 2008 or 2009 (Saudi Arabian Mining Co., 2006).

Bariq Mining Ltd., which was a subsidiary of Vertex Group (Middle East) WLL of Bahrain, and Central Mining Company Investments Ltd. of Saudi Arabia began a drilling program on the Jabal Sayid copper project. In December, ADV Group Ltd. of Australia proposed to acquire the Vertex Group.

Iron and Steel.—In 2006, Saudi Iron and Steel Co. (Hadeed) started production from a 500,000-metric-ton-per-year (t/yr)-capacity concrete-reinforcing bar (rebar) and wire rod mill and completed a capacity expansion of the hot-rolling mill at Hadeed's Jubail plant to 2 million metric tons per year (Mt/yr). Midrex Technologies, Inc. of the United States and Voest Alpine Industrieanlangenbau GmbH. & Co. of Austria continued the construction of a 1.76-Mt/yr-capacity direct-reduction iron (DRI) plant. The DRI plant was expected to start production of cold DRI in March 2007, followed by hot DRI. Hadeed, which had the capacity to produce 3.2 Mt/yr of long steel products (such as bars and rods) and 2.2 Mt/yr of flat steel products (such as cold- and hot-rolled coil, plates, and slab), proposed to increase its steel products capacity to 10 Mt/yr by 2015 (James, 2006; Kopfle, McClelland, and Metius, 2007; Saudi Basic Industries Corp., 2007, p. 27).

The Direct Reduction Iron Co., which was a subsidiary of Al Tuwairqi Group of Saudi Arabia, continued the installation and renovation of two DRI plants at Dammam. The capacity of each of the DRI plants was upgraded to 500,000 t/yr from its original 400,000 t/yr capacity. The DRI plants were expected to be commissioned in 2007. The DRI would supplement the scrap steel feed that was used to supply the electric arc furnace of Al Tuwairqi's National Steel Co. Ltd. (GRIPS media GmbH, 2007).

Al-Atoun Steel Industry Co. of Saudi Arabia proposed to start the construction of a 1-Mt/yr-capacity crude steel plant and a 500,000-t/yr-capacity rebar rolling mill at Yanbu in eastern Saudi Arabia in early 2007. Initial steel production was expected in late 2008. A 1.7-Mt/yr-capacity DRI plant was proposed to be built adjacent to the steel plant by 2009. In southwestern Saudi Arabia, Pan Kingdom Investment Co. started construction of the South Steel Factory, which was a 1-Mt/yr-capacity crude steel plant, at Jizan (Middle East Economic Digest, 2006a, b).

Niobium (Columbium), Tantalum, Yttrium, and Zircon.—Tertiary Minerals plc of the United Kingdom and Saudi partners A.H. Algosaiba & Bros. Co. and Al Nahla Trading and Contracting Co. continued their evaluation of the Ghurayyah tantalum prospect. Tertiary completed a 22-hole drilling program on the prospect as part of a prefeasibility study. In addition to tantalum, the prospect contained several other minerals, including niobium (columbium), yttrium, and zircon.

Industrial Minerals

Aluminum Fluoride.—In 2006, Al Zamil Holding Co. of Saudi Arabia and Industries Chemiques du Fluor of Tunisia formed a joint venture to build an aluminum fluoride manufacturing plant in Saudi Arabia. Initial production from the proposed plant was scheduled tentatively for 2008.

Cement.—Demand for cement from the Saudi Arabian construction sector resulted in an increase in cement production of nearly 1 Mt in 2006 compared with production in 2005, and a significant increase in gypsum production. A number of capacity expansions or new cement lines were under construction. Total installed domestic capacity was projected to reach about 31 Mt/yr by 2007 and about 39 Mt/yr by 2008 (Irish, 2006).

Nitrogen.—Saudi Arabian Fertilizer Co., which was a subsidiary of Saudi Basic Industries Corp., started production at the SAFCO IV plant at Jubail. The facility had a nominal annual capacity of 1.1 million metric tons (Mt) of ammonia and 1.1 Mt of granular urea (Saudi Basic Industries Corp., 2007, p. 24).

Mineral Fuels

Crude Oil.—To meet increased domestic and international demand for crude oil and to offset the natural production decline of older fields, Saudi Aramco had several projects underway to increase total production capacity to 12 million barrels per day (Mbbl/d) by 2009. In 2005 and 2006, production was about 9 Mbbl/d, and the production capacity was about 10.5 to 11 Mbbl/d. Projects included the development of the 1.2-Mbbl/d-capacity Abu Jifan and Mazalij Fields; the redevelopment of the 900,000-barrel-per-day (bbl/d)-capacity Manifa Field; the addition of 500,000 bbl/d of production capacity with the development of the Abu Hadriyah, the Fadhili, and the Khursaniyah Fields; the development of the 100,000-bbl/d-capacity Nuayyim Field; and the expansion of production capacity at the Safaniyah and the Shaybah Fields. The projected increase in crude oil output also would produce a significant volume of associated natural gas (Saudi Arabian Co., 2007, p. 22-25; U.S. Energy Information Administration, 2007a).

Outlook

With its crude oil resources, Saudi Arabia is well placed to meet international demand for petroleum, but historically, any sustained worldwide economic downturn and the resultant decline in demand for hydrocarbons have had a significant negative impact on the national economy. Saudi Aramco expects to continue its program to increase production of premium-priced light and extra light grades of crude oil and to decrease the production of heavy and medium grades of crude oil.

The Kingdom's privatization program and encouragement of private investment in mineral projects is expected to be attractive to international investors. Significant infrastructure development, which could include the establishment of new cities (including Jizan Economic City at Jizan, King Abdullah Economic City at Rabig, Knowledge Economic City at Al-Madinah, and Prince Abdulaziz Bin Mousaed Economic City at Hail) and the expansion of the highway and railroad network, will likely raise the short-term demand for construction minerals and products, such as cement, glass, sand, steel, and stone. Shortages of steel scrap and a constricted supply of natural gas, however, could affect the output of the country's expanding

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steel production sector, as could a downturn in the booming regional construction industry. In the event of a downturn in the construction industry, the massive increase in Saudi Arabian cement production capacity could result in a significant oversupply of cement.

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TABLE I
SAUDI ARABIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity[2]		2002[e]	2003[e]	2004	2005	2006[p]
METALS						
Ferroalloys[e]		-- [r]	-- [r]	-- [r]	-- [r]	85,000
Iron and steel:						
Iron ore, for cement		NA	NA	503,500	582,000 [r]	722,000
Direct-reduced iron	thousand metric tons	3,290 [3]	3,290 [3]	3,410	3,630	3,580
Steel, crude	do.	3,570 [3]	3,944 [3]	3,902	4,185	4,000
Metal ore, mine output:						
Gross weight[e]		2,000,000	2,000,000	2,200,000	4,683,000 [r]	5,365,000 [3]
Copper content of concentrate and bullion		800	800	652	668	730
Gold content of concentrate and bullion	kilograms	4,192 [3]	8,769 [3]	8,268	7,456	5,180
Lead content of concentrate[e]		60	60	30	-- [r]	-- [3]
Silver content of concentrate and bullion[e]	kilograms	14,000	13,000	14,494 [3]	13,501 [3]	9,100 [3]
Zinc content of concentrate[e]		3,000	3,000	1,500	-- [r]	983 [3]
INDUSTRIAL MINERALS						
Barite		9,000	9,000	15,000	15,000	23,300
Cement, hydraulic	thousand metric tons	22,000	23,000	25,370	26,064	27,055
Fertilizer, phosphatic, P_2O_5 content[e]	do.	150	150	295	300	300
Gypsum, crude	do.	450	450	641	713	2,200
Lime[e]		350,000	350,000	350,000	360,000	360,000
Nitrogen:						
N content of ammonia	thousand metric tons	1,737 [3]	1,743 [3]	1,726	1,780	2,000
N content of urea	do.	1,241 [3]	1,247 [3]	1,242	1,250	1,400
Salt	do.	1,000 [r]	1,300	1,530	1,738	1,752
Sand and stone:						
Aggregate	do.	120,000	120,000	156,300	190,000	217,000
Basalt	do.	NA	NA	NA	43	53
Dolomite	do.	NA	NA	530	498	550
Granite	do.	NA	NA	716	843	962
Limestone	do.	NA	NA	32,000	30,600	30,500
Marble	do.	NA	NA	82	85	85
Pozzolana and scoria	do.	152	162	320	372	400
Sand and gravel	do.	NA	NA	33,100	28,000	35,000
Silica sand (glass sand)	do.	NA	NA	625	518	782
Sulfur, byproduct, hydrocarbon processing		2,363,614 [3]	2,180,000	2,249,295	2,716,823	2,906,911
MINERAL FUELS AND RELATED MATERIALS						
Gas, natural:						
Gross	million cubic meters	63,978 [3]	67,389 [3]	75,967	81,350	85,001
Dry	do.	57,314 [3]	60,060 [3]	68,000	68,547 [r, 3]	70,878
Petroleum:						
Crude oil	million 42-gallon barrels	2,479 [3]	2,958 [r, 3]	3,151	3,309	3,253
Condensate	do.	NA	44 [3]	82	89	94
Natural gas liquids:						
Propane	thousand 42-gallon barrels	139,270 [3]	144,837 [3]	148,225	150,588	149,320
Butane	do.	91,858 [3]	87,812 [3]	91,060	94,148	94,338
Natural gasoline and other	do.	85,810 [3]	68,422 [3]	65,647	66,299	61,456
Total	do.	316,938 [3]	301,071 [3]	304,932	311,035	305,114
Refinery products:						
Liquefied petroleum gases	do.	10,340 [3]	10,150 [3]	13,400	12,740	14,730
Gasoline and naphtha	do.	153,000	171,720 [3]	198,570	198,870	186,420
Jet fuel and kerosene	do.	59,700	65,550 [3]	66,980	80,910	77,330
Distillate fuel oil	do.	193,000	215,590 [3]	234,890	236,370	241,790
Residual fuel oil	do.	158,000	169,380 [3]	172,790	177,970	181,000
Unspecified[4]	do.	9,180	10,240 [3]	11,490	13,780	14,160
Total	do.	583,000	642,630 [3]	698,120	720,640	715,430

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. NA Not available. [p]Preliminary. [r]Revised. -- Zero.
[1]Table includes data available through November 13, 2007.
[2]In addition to commodities listed, carbon black, clays, and methanol were produced, but available information is inadequate to make estimates of output.
[3]Reported figure.
[4]Includes asphalt.

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TABLE 2
SAUDI ARABIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Thousand metric tons unless otherwise specified)

Commodity	Major operating companies and major equity owners	Location of facilities	Annual capacity
Cement[1]	Yanbu Cement Co.	Yanbu	4,300
Do.	Saudi Cement Co.	Ayn Dar, about 120 kilometers southwest of Dammam	1,450
Do.	do.	Al Hofuf, about 120 kilometers southwest of Dammam	2,700
Do.	Southern Province Cement Co. (Government, 40%)	Suq Al Ahad, 10 kilometers northeast of Jizan	1,900
Do.	do.	Bishah, 550 kilometers southeast of Jiddah	1,300
Do.	Arabian Cement Co. Ltd.	Rabigh	3,100
Do.	Eastern Province Cement	Al Khursaniyah	3,500
Do.	Yamama Cement Co.	Riyadh	3,000
Do.	Qasim Cement Co.	Jal al Watah, 18 kilometers north of Buraydah	2,100
Do.	Tabuk Cement Co.	Tabuk	1,500
Do.	Saudi White Cement	About 30 kilometers southwest of Riyadh	200
Copper, Cu content of ore	Saudi Arabian Mining Co. (Ma'aden) (Government, 100%)	Al-Hajar and Mahd Al-Dahab Mines	1,000
Gold kilograms	Saudi Arabian Mining Co. (Ma'aden) (Government, 100%)	Al-Hajar, Bulgah, and Mahd Al-Dahab Mines, and Sukhaybarat plant	8,000
Petroleum:			
Crude million barrels	Saudi Arabian Oil Co. (Saudi Aramco) (Government, 100%)	Eastern Province, Najd Region, and offshore; includes the Ghawar, the Hawtah, the Safaniya, and the Shaybah Fields	3,900
Refined products do.	Saudi Arabian Oil Co. (Saudi Aramco) (Government, 100%)	Ras Tanura	193
Do. do.	Rabigh Petroleum Refining Co. [Saudi Arabian Oil Co. (Saudi Aramco), 100%]	Rabigh	140
Do. do.	Saudi Aramco Mobil Refinery Co. Ltd. [Saudi Arabian Oil Co. (Saudi Aramco), 50%, and Mobil Yanbu Refining Company Inc., 50%]	Yanbu	140
Do. do.	Saudi Aramco Shell Refining Co. [Saudi Arabian Oil Co., (Saudi Aramco), 50%, and Shell Saudi Arabia Refining Ltd., 50%]	Al Jubayl	110
Do. do.	Saudi Arabian Oil Co. (Saudi Aramco) (Government, 100%)	Yanbu	69
Do. do.	Riyadh Oil Refinery Co. [Saudi Arabian Oil Co. (Saudi Aramco), 100%]	Riyadh	50
Do. do.	Jeddah Oil Refinery Co. [Saudi Arabian Oil Co. (Saudi Aramco), 100%]	Jeddah	38
Steel, crude	Saudi Iron and Steel Co. (Hadeed) (Saudi Basic Industries Corp., 100%)	Al Jubayl	2,700
Do.	National Steel Co. Ltd. (Al Tuwairqi Group, 100%)	Dammam	800
Titanium dioxide	The National Titanium Dioxide Co. Ltd. (Cristal) (Gulf Investment Corp. of Kuwait; National Industrialization Co. of Saudi Arabia; Shairco Trading Industry and Contracting of Saudi Arabia)	Yanbu	100
Zinc, Zn content of ore	Saudi Arabian Mining Co. (Ma'aden) (Government, 100%)	Al-Hajar and Mahd Al-Dahab Mines	2,000

[1]In 2006, production from most cement plants exceeded nominal capacity.

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The Mineral Industry of Syria

By Thomas R. Yager

In 2006, Syria played a significant role in the world's production of phosphate rock; the country's share of global phosphate rock output amounted to 2%. Other domestically significant mining and mineral processing operations included cement, crude petroleum, natural gas, and petroleum products (Jasinski, 2007).

Minerals in the National Economy

In 2006, the output of the petroleum sector amounted to 23.6% of the gross domestic product. Exports of crude petroleum and petroleum products accounted for 40% of total exports in 2006 compared with nearly 58% in 2003 (International Monetary Fund, 2007, p. 36-37).

Production

In 2006, the production of salt increased by 21%; sulfur, 19%; phosphate rock, 5%; and dry natural gas, 3%. Crude petroleum production continued its long-term decline; output decreased by 9% in 2006. Gypsum production declined by 5%.

Structure of the Mineral Industry

Many of Syria's significant mining and mineral processing operations (cement, petroleum products, phosphate rock, phosphatic fertilizers, phosphoric and sulfuric acid) were owned by the Government. Crude petroleum and natural gas production was controlled by a mixture of state-owned and private companies. Most of the steel mills were privately owned.

Commodity Review

Industrial Minerals

Cement.—Syria's cement plants had a total capacity of about 5.4 million metric tons per year (Mt/yr); national cement demand amounted to 6.5 Mt/yr. Cement was imported from Egypt, Jordan, Lebanon, and Turkey. State-owned General Organization for Cement and Building Materials (GOCBM) and Military Housing Cement Group produced an estimated 4.7 Mt/yr. GOCBM planned to increase the national cement production capacity to 10 Mt/yr; the company planned to lease its plants to private investors for a period of 15 years for capacity upgrades and to allow private investors to build new plants. The tenders for the leases were cancelled in August 2006. Ehdasse Sanat Corp. of Iran was expected to complete a new plant in Hama with a capacity of 1 Mt/yr by early 2007. Sinohydro Corp. of China signed an agreement with privately owned Farzat Company to build a new plant near Damascus with a capacity of 1.8 Mt/yr (Pepper, 2005; Kalhasan and Lederer, 2006; Middle East Economic Digest, 2006a).

Mineral Fuels

Natural Gas.—In 2006, Syria had five natural-gas processing plants with a combined capacity of nearly 10.7 billion cubic meters per year. Syria planned to increase its natural gas production capacity by about 4.4 billion cubic meters per year by 2010. In 2006, Stroytransgas OJSC of Russia was building a gas-processing plant with a capacity of 2.2 billion cubic meters per year near Palmyra as part of the Middle Area Gas Project. The Government was negotiating with Stroytransgas for the construction of another new plant with a capacity of 1.1 billion cubic meters per year. INA Naftaplin of Croatia planned to build a plant with a capacity of between 1.1 and 1.3 billion cubic meters per year at its Hayan block (Pepper, 2006).

In May 2006, Marathon Oil Company of the United States signed a production-sharing agreement with Syrian Gas Company (SGC) for natural gas and petroleum at al-Shaaer and al-Shareefa fields near Palmyra. These fields were expected to produce as much as 730 million cubic meters per year of natural gas. Marathon or SGC could develop another gas-processing plant (Pepper, 2006).

Petroleum.—Syria's production of crude petroleum declined to 416,000 barrels per day (bbl/d) in 2006 from 458,000 bbl/d in 2005 and 495,000 bbl/d in 2004. The al-Furat Petroleum Company (AFPC) was Syria's leading producer of crude petroleum. AFPC and Deir ez-Zor Petroleum Company produced light crude.

In October 2006, Royal Dutch Shell Group signed agreements to explore for natural gas and petroleum in Blocks 13 and 15 in southeastern Syria. Soyuzneftgas of Russia signed an agreement in May to explore in Block 12.

Banias Refinery Company and Homs Refinery Company had a combined capacity of about 242,000 bbl/d. In 2006, the Government was negotiating with National Iranian Oil Company International and Petróleos de Venezuela to build a new refinery with a capacity of 150,000 bbl/d. The Government was also considering a joint venture with private investors to build another refinery with a capacity of 150,000 bbl/d (Middle East Economic Digest, 2006b).

Outlook

Syria's production of crude petroleum is likely to continue to decline to 352,000 bbl/d in 2008 and 330,000 bbl/d in 2012 because of maturing oilfields and aging equipment. Production of natural gas is expected to increase in response to likely increases in domestic demand. Cement and steel production are also likely to increase because of growth in the construction sector. Syria is expected to be a net petroleum importer by 2010 because of declining crude petroleum production (Pepper, 2006; International Monetary Fund, 2007, p. 37).

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TABLE 1
SYRIA: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2002	2003	2004	2005[e]	2006[e]
Cement, hydraulic	thousand metric tons	4,679	4,824	4,757	4,700 [r]	4,700
Gas, natural:						
Gross[e]	million cubic meters	9,300	9,401 [2]	9,700	8,300 [r]	8,600
Dry	do.	6,800	6,850	7,110 [r]	6,090 [r, 2]	6,290 [2]
Gypsum		350,088	376,715	431,561	467,000 [r, 2]	443,800 [2]
Nitrogen:						
N content of ammonia		142,800	161,100	115,000	120,000	120,000
N content of urea		88,500	90,700	91,000 [e]	91,000	91,000
Petroleum:						
Crude	thousand 42-gallon barrels	200,000 [r]	192,000 [r]	181,000 [r]	167,000 [2]	152,000 [2]
Refinery products:						
Liquefied petroleum gas	do.	3,399	3,318	3,318	3,300	3,300
Gasoline	do.	11,959	10,739	11,413	11,000	11,000
Naphtha	do.	4,842	5,812	7,028	7,100	7,100
Jet fuel	do.	1,491	1,618	1,943	2,000	2,000
Kerosene	do.	495	301	448	450	450
Distillate fuel oil	do.	31,093	29,139	30,758	31,000	31,000
Residual fuel oil	do.	39,667	31,921	30,210	30,000	30,000
Asphalt	do.	2,800	2,500	2,500	2,500	2,500
Other	do.	950	850	900	900	900
Total	do.	96,700	86,200	88,500	88,300	88,300
Phosphate:						
Phosphate rock, mine output:						
Gross weight	thousand metric tons	2,483	2,414	2,883	3,500 [r, 2]	3,664 [2]
P_2O_5 content	do.	770	750	890	1,080 [r]	1,130
P_2O_5 equivalent:						
Phosphatic fertilizers		123,000	91,000	127,000	130,000	130,000
Phosphoric acid		102,000	73,000	97,000	100,000	100,000
Salt		145,018	128,265	141,445	110,000 [r, 2]	133,000
Steel:						
Crude		70,000	70,000	70,000	70,000	70,000
Semimanufactured		400,000	600,000	800,000	800,000	800,000
Stone:[e]						
Dolomite, refractory grade	thousand metric tons	5,000	5,000	5,000	5,000	5,000
Gravel and crushed rock	do.	6,000	6,000	6,000	6,000	6,000
Marble blocks	do.	340 [2]	340	340	340	340
Sand, construction	thousand cubic meters	450	450	450	450	450
Sand, industrial	thousand metric tons	850	850	850	850	850
Volcanic tuff	do.	650	650	650	650	650
Sulfur						
Byproduct of petroleum and natural gas		11,740 [r]	13,516 [r]	14,996 [r]	36,074 [r]	43,000
Sulfuric acid:						
Gross weight		344,000	250,000	362,000	360,000	360,000
S content		112,000	82,000	118,000	117,000	117,000

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised.

[1]Table includes data available through November 16, 2007.

[2]Reported figure.

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TABLE 2
SYRIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity
Cement		Tartous Company for Cement & Building Materials[1]	Tartous	1,802.
Do.		al-Chaba Cement & Building Materials[1]	Aleppo	923.
Do.		Arabian Cement Co. for Cement[1]	do.	898.
Do.		Adra Co. for Cement and Building[1]	Adra	845.
Do.		Syrian Co. for Manufacturing Cement[1]	Hama	432.
Do.		Rastan Co. for Cement and Building Materials[1]	Rastan	131.
Do.		Military Housing Cement Group (Government, 100%)	Musselemieh	336.
Natural gas	million cubic meters	ConocoPhillips Company	Processing plant at Deir ez-Zor	4,750.
Do.	do.	al-Furat Petroleum Company (Syrian Petroleum Company, 50%; Royal Dutch Shell, 33.3%; Bergamo Holding, 16.7%)	Processing plant at Omar	2,400.
Do.	do.	Syrian Petroleum Company (Government, 100%)	Processing plant at Palmyra	2,200.
Do.	do.	do.	Processing plant at Jebissa	1,060.
Do.	do.	do.	Processing plant at Suwaidiyah	240.
Nitrogen:				
Ammonia and urea[2]		General Fertilizers Company (subsidiary of General Organization for Chemical Industries)	Homs	256 ammonia; 137 urea.
Fertilizers		do.	do.	109.
Petroleum:				
Crude	thousand 42-gallon barrels	al-Furat Petroleum Company	al-Thayyem	20,000.
Do.	do.	do.	al-Izba	18,300.
Do.	do.	do.	Omar/Omar North	14,600.
Do.	do.	do.	Maleh/Azraq	11,000.
Do.	do.	do.	Sijan	11,000.
Do.	do.	do.	Jarnof/Saban	9,100.
Do.	do.	do.	al-Ward	7,300.
Do.	do.	do.	Tanak	6,600.
Do.	do.	Syrian Petroleum Company	Suwaidiyah, Jebissa, and Karatchok	45,600.
Do.	do.	Deir-ez Zor Petroleum Company (Syrian Petroleum Company, 50%, and Total S.A., 50%)	Qahar	10,200.
Do.	do.	do.	Jafra	4,700.
Do.	do.	do.	al-Mazraa and Attala North	3,700.
Do.	do.	al-Khabur Petroleum Co. (Syrian Petroleum Company, 50%)	Kishma	5,800.
Do.	do.	Tanganyika Oil Co.	Tishreen	2,190.
Refined	do.	Banias Refinery Company (Government, 100%)	Banias	49,300.
Do.	do.	Homs Refinery Company (Government, 100%)	Homs	39,100.
Phosphate:				
Phosphate rock		General Company for Phosphate and Mines (Government, 100%)	Alsharqia (A and B Mines)	3,050.
Do.		do.	Kneifis	800.
Phosphatic fertilizers		General Fertilizers Company	Homs	450.
Phosphoric acid		do.	do.	165.
Salt		General Company for Phosphate and Mines	Deir al-Zour	72.
Steel:				
Billet		General Company for Iron and Steel Products (Government, 100%)	Hama	60.
Rolled		Merri Family	Tartous	300.
Do.		Arab Steel Co.	Lattakia	250.
Do.		JoudCo Steel	do.	150.
Do.		Middle East Steel Industries	Yabroud	140.
Do.		General Company for Iron and Steel Products	Hama	78.

See footnotes at end of table.

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TABLE 2--Continued
SYRIA: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies	Location of main facilities	Annual capacity
Sulfur	metric tons	Homs Refinery Co.	Homs	14,600.
Do.	do.	do.	Processing plant at Suwaidiyah	7,410.
Do.	do.	Syrian Petroleum Company	Processing plant at Jebissa	7,300.
Sulfuric acid		General Fertilizers Company	Homs	560.

[1]Subsidiary of General Organization for Cement and Building Materials, which is 100% Government owned.
[2]Expressed in nitrogen equivalent.

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The Mineral Industry of Turkey

By Philip M. Mobbs

Turkey had a diverse mineral industry and was a leading producer of barite, bentonite, boron minerals, chromite, feldspar, kaolin, limestone, magnesite, marble, perlite, and pumice. Turkey also was a significant source of value-added processed mineral commodities, such as cement, ceramics, glass, and steel.

Minerals in the National Economy

Mining and quarrying accounted for about 1.08% of the gross domestic product (GDP) (calculated at 1987 producers' prices) in 2006, slightly down from 1.10% in 2005 and 1.5% in 1996. In 2006, the mining sector posted a 4.8% growth rate compared with 2005. The construction sector accounted for 4.7% of GDP in 2006 compared with 4.2% in 2005 and 5.9% in 1996; the energy sector accounted for 3.4% of GDP in 2006 compared with 3.3% in 2005 and 3.1% in 1996. Compared with 2005, the construction sector posted a 19.4% growth rate in 2006, and the energy sector, 8.7%. Of the civilian labor force of about 24.8 million, 4.4 million were employed in the industrial sector, which included the mineral processing, mining, and petroleum sectors, and about 1.3 million in the construction sector (T.C. Başbakanlık Devlet Planlama Teşkilatı Müsteşarlığı, 2007a, tables II-4, IX-1).

Government Policies and Programs

Article 168 of the Constitution (1982) and the Mining Law of June 15, 1985 (Maden Kanunu, law No. 3213) declared that natural resources, such as minerals, belonged to the state and were not considered to be part of the land where they were found. Law No. 5177 of 2004 (the new mining law, which amended the 1985 mining law), the "Regulation Concerning the Implementation of the Mining Law" issued in 2005, and the "Mining Activities Permitting Regulation of 2005" also regulated mining activity in Turkey. The Government issued licenses to Turkish individuals or legal entities to explore for minerals or operate mines for a specific period of time. The Foreign Direct Investment Law of June 2003 (law No. 4875) authorized foreign investors to establish companies in Turkey that could hold mining rights under the Mining Law.

Maden İşleri Genel Müdürlüğü (the General Directorate of Mining Affairs) of the T.C. Enerji ve Tabii Kaynaklar Bakanlığı (Ministry of Energy and Natural Resources) regulated the mining industry. T.C. Çevre ve Orman Bakanlığı (the Ministry of Environment and Forestry) enforced the Environmental Law of 1983 (law No. 2872) and the "Regulation on Environmental Impact Assessment" of December 16, 2003.

State-owned Eti Maden İşletmeleri Genel Müdürlüğü retained exclusive rights to explore and to develop boron deposits under law No. 2840 of 1983. Boron operations had been nationalized by law No. 2712 of 1978.

In general, mineral exports were not prohibited under either Export Regime Decree No. 95/7623 of 1995 or Amended Communique No. 96/31 of 2000 (Concerning Goods the Export of which is Banned or Subject to Pre-authorization); the export of dual-use and sensitive goods, however, was administered by T.C. Başbakanlık Dış Ticaret Müsteşarlığı (the Undersecretariat of Foreign Trade) under Communique No. 2003/12 of December 2, 2003. Dual-use and sensitive goods included machinery, material, and software that were usable for either civilian or military purposes, such as high-tensile-strength metal alloys.

Petroleum exploration and production were administered by the Ministry of Energy and Natural Resources under the Petroleum Law of 1954 (law No. 6326). The distribution, export, import, refining, and sale of petroleum were licensed under and regulated by the Petroleum Market Law of 2003 (law No. 5015). The distribution, export, import, and transmission of natural gas was regulated by the Natural Gas Market of 2001 (law No. 4646). The marketing of domestic and imported liquefied petroleum gases was regulated by the Liquefied Petroleum Gases (LPG) Market Law of 2005 (law No. 5307).

Production

Significant increases in production were noted for alumina, bauxite, and ferrochromium. Significant increases in production were estimated for antimony, borates, feldspar, glass, manganese ore, and zinc ore and concentrate. A significant decrease in production was posted for chromium. Significant decreases in production were estimated for copper ore, lead ore and concentrate, magnesite, and nitrogen (ammonia). Data on mineral production are provided in table 1.

Structure of the Mineral Industry

The private sector dominated the country's industrial minerals and metals sectors. In 2006, the Government's privatization of state-owned companies continued. Establishments divested by the Government's T.C. Başbakanlık Özelleştirme İdaresi Başkanlığı (Privatization Administration) included the petroleum refineries of Türkiye Petrol Rafineleri A.Ş. (Tupraş); the assets of Tütün, Tütün Mamulleri, Tuz ve Alkol İşletmeleri A.Ş.' (Tekel) Kaldırım, Kayacık, and Yavşan salt mines; and the iron and steel operations of Ereğli Demir ve Çelik Fab. T.A.Ş (Erdemir).

Mineral Trade

In 2006, total Turkish exports of goods were valued at about $85.5 billion compared with a revised $73.5 billion in 2005. Of the total exports in 2006, iron and steel accounted for about $6.3 billion; refined petroleum products, $3.4 billion; metalliferous ores and metal scrap, about $764 million; fertilizers and crude ores, $729 million; glass and glassware, about $679 million; boron chemicals, about $367 million; and natural gas, about $180 million.

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Total imports were valued at about $139.6 billion in 2006, of which, mineral fuels accounted for about $28.9 billion, and iron and steel, $11.5 billion (Eti Maden İşletmeleri Genel Müdürlüğü, 2007; T.C. Başbakanlık Devlet Planlama Teşkilatı Müsteşarlığı, 2007a, tables V-2, V-11, V-15, V-16).

Commodity Review

The increased prices of minerals worldwide and the 2004 amended Mining Law accounted for a significant increase in interest in mining and mineral processing activity in Turkey. In the first 8 months of 2006 (the latest period for which data were available), 9,171 exploration licenses were granted, compared with 9,832 in calendar year 2005 and 4,385 in 2004. In 2006, 455 new mining or quarrying companies were established in Turkey, and 45 mining or quarrying companies were closed (T.C. Başbakanlık Devlet Planlama Teşkilatı Müsteşarlığı, 2007b, p. 155).

Metals

Copper.—In August, onsite work was suspended at Inmet Mining Corp. of Canada's Cerattepe underground copper-zinc mine, which was located near Artvin. The local Erzurum Administrative Court ruled that the Government had incorrectly exempted the operating licenses for the Cerattepe project from environmental assessment regulations. The Ministry of Energy and Natural Resources appealed the Court's decision. Inmet had planned to truck ore from Cerattepe to the Cayeli Mine, which was located about 100 kilometers (km) east of the Cerattepe project (Inmet Mining Corp., 2007, p. 64-66).

Anatolia Minerals Development Ltd. and Rio Tinto plc of the United Kingdom completed another drill program on the Bursa copper prospect. Nuinsco Resources Ltd. of Canada evaluated the Berta and the Elmalaan copper prospects in northeastern Turkey and Stratex International plc of the United Kingdom initiated exploration on the Muratdere project.

Gold.—Turkey's diverse geologic settings have presented exploration companies with a variety of gold deposit types to evaluate, including carbonate-replacement deposits, Carlin-type deposits, epithermal systems, iron oxide copper-gold deposits, orogenic deposits (listwanite-hosted and mesothermal), placers, porphyry systems, and volcanic-associated massive sulfide (both Cyprus- and Kuroko-type) deposits (Yigit, 2006).

In 2006, Koza Altin Işletmeleri A.Ş. began trial mining at Havran-Kucukdere [where more than 50,000 metric tons (t) of ore was produced] and at Mastra (5,000 t of ore). Ore was shipped to the company's Ovacik processing plant, which was located near Bergama. In July, Eldorado Gold Corp. of Canada began commercial production at the 7,500-kilogram-per-year-capacity Kisladag gold mine, which was located about 180 km east of Izmir.

Companies exploring for gold in Turkey in 2006 included Aldridge Minerals Inc. of Canada, which drilled the Yenipazar copper-gold-lead-silver-zinc property; Anatolia Minerals Development, which completed a feasibility study on the Çopler gold project; and Ariana Resources plc of the United Kingdom, which explored the Cinarpinar gold, the Kiziltepe gold, and the Kosedere copper-zinc prospects.

The joint venture of Cloudbreak Resources Ltd. of Canada and Anatolia Minerals Development initiated exploration on the Sarp-Ikiztepe gold property. Eldorado drilled the Efemçukuru Project. Eurasian Minerals Inc. of Canada undertook preliminary exploration of the Akarca gold-silver and the Golcuk copper-silver prospects. Fronteer Development Group of Canada drilled the Agi Dagi gold, the Halilaga copper-gold, the Kirazli gold, and the Pirentepe gold prospects.

In 2006, Kefi Minerals Plc of Turkey was spun off from EMED Mining Public Ltd. of Cyprus (formerly Eastern Mediterranean Resources Public Ltd.). Kefi undertook preliminary exploration of the Artvin Project. Mediterranean Resources Ltd. of Canada worked on the Tac copper-gold and the Corak gold properties. Odyssey Resources Ltd. of Canada worked on the Tavsan gold prospect. Stratex International drilled, mapped, or sampled several projects in the Konya volcanic belt, which included the Doganbey, the Inlice, the Karaagac, and the Oglacki prospects.

Nickel.—In April, European Nickel PLC of the United Kingdom completed an updated definitive feasibility study of the Çaldağ nickel project. European Nickel started mining in September after the company agreed to ship 200,000 t of nickel ore to GMM SA Larco of Greece during a 12-month period. European Nickel had shipped ore to Larco during a trial mining exercise in 2003. In December, the planned construction of the mine's leach pads and the 20,400-metric-ton-per-year (t/yr)-capacity nickel and 1,200-t/yr-capacity cobalt hydroxide processing plant was delayed, pending the receipt of a forestry permit from the Ministry of Environment and Forestry (European Nickel PLC, 2006).

Zinc.—ZincOx Resources plc of the United Kingdom continued work on an environmental impact assessment for its Aliaga recycling project, which was located about 60 km north of Izmir. ZincOx planned to treat 200,000 t/yr of electric arc furnace dust (EAFD), which contained about 24% zinc, to produce 91,000 t/yr of zinc concentrate, 46,000 t/yr of pig iron, and 39,000 t/yr of slag (ZincOx Resources plc, 2007, p. 11).

Silvermet Inc. of Canada (which was formed in 2006 by the merger of Atikokan Resources Inc. and Silvermet Corp.) and Anatolia Minerals Development drilled the Tufanbeyli zinc prospect and initiated the evaluation of processing Tufanbeyli ore and EAFD together in a Waelz kiln. Silvermet proposed to build a 65,000-t/yr-capacity plant to produce zinc oxide (Silvermet Inc., 2007).

Outlook

Turkey has significant resources of bentonite, boron, lignite, marble, and perlite. Although there are numerous other mineral deposits in Turkey, most mineral occurrences tend to be of small- to medium-size relative to deposits in other parts of the world, which leads to more international investor interest in the development of high-value minerals, such as gold (Ersçen, 1989). Administrative and legal difficulties, such as those that resulted in the suspension of operations at the Ovacik gold mine, the delayed permission to construct the Çaldağ nickel mine's heap leach pads and processing plant, and the legal proceedings to cancel previously issued licenses for the Cerattepe copper

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and zinc project, could raise questions about possible future problems with mineral development projects in Turkey.

As a major energy transit corridor, Turkey could connect energy producers in Asia with consumers in Europe. Natural gas from Iran and Russia is piped into Turkey. The south Caucasus gas pipeline is expected to begin deliveries of natural gas to Turkey from Azerbaijan beginning in 2007. Connection of the Turkish natural gas pipeline system with the European gas network could provide an alternative route to allow surplus Eurasian and Iranian natural gas to flow into Europe. In 2006, the Baku-Tbilisi-Ceyhan oil pipeline delivered crude oil from Azerbaijan to the export terminals of the Ceyhan oil docks. Crude oil from Iraq intermittently moved through Turkey to Ceyhan; throughput was limited by the frequent sabotage of the Iraqi section of the pipeline. Regular shipments of crude oil from Iraq are not expected to resume until the security situation in Iraq is resolved.

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TABLE 1
TURKEY: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2002	2003	2004	2005[e]	2006[e]
METALS						
Aluminum		62,501 [3]	63,000	60,000	60,000	60,000
Antimony:[e]						
Ore, mine output:						
Gross weight		4,800	12,500	20,107 [3]	28,000	35,000
Sb content		250	650	900	1,400	1,800
Concentrates:						
Gross weight		1,000	2,000	3,000	5,000	6,000
Sb content		150	400	700	1,200	1,500
Bauxite and alumina						
Bauxite[2]		287,403	364,306	365,836	475,349 [3]	771,227 [3]
Alumina, gross weight		152,869	162,174	169,991	112,558 [3]	140,089 [3]
Chromium, gross weight (34% to 43% chromic oxide)[4]		313,637	229,294	506,421	688,377 [r, 3]	457,893 [3]
Copper:						
Mine output, exclusive of pyrite:[5]						
Gross weight		2,942,721	2,620,896	2,356,147	2,946,106	2,500,000
Cu content of ore		48,253	58,000 [e]	49,000 [e]	54,000 [r]	46,000
Metal:						
Smelter output, primary and secondary		32,550	30,400 [e]	34,700 [r]	27,600 [r]	30,000
Refined[e]		41,000	45,000	64,000 [r]	95,000	106,000
Gold[e, 6]	kilograms	5,000	6,500	4,500	5,000	4,500
Iron and steel:						
Iron ore:						
Gross weight	thousand metric tons	3,433	3,429	4,120	4,598 [3]	3,251 [3]
Fe content[e]	do.	1,830	1,830	2,200	2,450	1,730
Metal:						
Pig iron and ferroalloys:						
Ferrochromium		11,200	35,393	28,701	26,043 [3]	67,975 [3]
Ferrosilicon		7,245	7,000 [e]	--	4,000	2,000
Pig iron		157,622	181,080	213,210	215,000	220,000
Steel, crude including castings	thousand metric tons	16,046	18,298	20,478	20,960 [3]	23,300
Lead:						
Mine output, Pb and Pb-Zn ores:						
Gross weight		375,592	379,250	407,637	450,000	400,000
Pb content		17,352	17,500	18,650	21,000	16,500
Concentrates:[e]						
Gross weight		25,000	25,000	26,000	29,000	23,000
Pb content		16,000	16,000	17,000	19,000	15,000
Metal, refined[e]		4,000	6,000	6,000	6,000	6,000
Manganese ore, gross weight[7]		20,000	18,000	13,751	15,000	35,000
Nickel, mine output, Ni content[e]		NA	640	40	1,000	1,000
Silver, mine output, Ag content[8]	kilograms	79,000	95,000	73,000 [e]	80,000	80,000
Zinc:						
Mine output, Zn and Cu-Zn ore:						
Gross weight	thousand metric tons	895	930	765	1,000	1,500
Zn content	do.	46	47	44	50	80
Concentrates:[e]						
Gross weight		49,000	49,000	49,000	53,000	90,000
Zn content		33,100	33,600	33,400	36,000	60,000
INDUSTRIAL MINERALS						
Aluminum sulfate, alunite		11,389	10,458	10,920	11,000	11,000
Barite, crude		106,843	119,648	134,504	157,179 [3]	200,000
Boron minerals:						
Run of mine		2,214,064	2,207,092	2,878,930	3,478,784 [r, 3]	3,955,574 [3]
Concentrates		1,368,000	1,399,000	1,587,992 [r]	1,824,571 [r, 3]	1,818,944 [3]
Refined borates		436,000	518,000	714,538 [r]	923,253 [r, 3]	1,021,139 [3]
Cement, hydraulic	thousand metric tons	32,576	35,077	38,796	42,787 [3]	47,977 [3]

See footnotes at end of table.

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TABLE 1--Continued
TURKEY: PRODUCTION OF MINERAL COMMODITIES[1]

(Metric tons unless otherwise specified)

Commodity		2002	2003	2004	2005[e]	2006[e]
INDUSTRIAL MINERALS--Continued						
Clays:						
Bentonite		559,224	831,146	850,000 [e]	925,000	1,000,000
Kaolin		372,344	370,455	536,008	580,000	650,000
Other[e]		2,500,000	2,500,000	2,750,000	2,750,000	3,000,000
Diatomite		10,000	10,000	10,000	10,000	11,000
Emery		15,418	15,402	7,902	12,000	13,000
Feldspar, run of mine		1,766,387	1,862,310	1,983,336	2,331,971 [r, 3]	2,900,000
Fluorspar		5,344	718	880	800	1,000
Glass, crude	thousand metric tons	1,242	1,315	1,229	1,058 [3]	2,518
Graphite, run of mine[e]		1,393 [3]	942 [3]	1,000	6,000	8,000
Gypsum, other than that for cement		264,038	196,668	250,099	250,000	300,000
Lime[e, 9]	thousand metric tons	3,300	3,300	3,400	3,400	3,500
Magnesium, magnesite, run of mine		3,044,440	3,224,278	3,732,952	3,400,000	2,088,033 [3]
Nitrogen, N content of ammonia		300,500	289,300	329,400	330,000	100,000
Perlite, run of mine		151,902	136,683	133,829	156,935 [r, 3]	120,000
Pumice		820,347	895,616	1,035,975	1,000,000	930,000
Pyrites, cupreous, gross weight		952,094	1,103,872	765,432	800,000	900,000
Sepiolite, meerschaum[e]	kilograms	300	200	150	170	130
Silica sand, gross weight	thousand metric tons	1,274	1,283	1,188	1,200	1,200
Sodium compounds:						
Salt, NaCl, all types	do.	2,197	2,243	2,158	2,253 [r, 3]	2,800
Soda ash, trona[e]	do.	825	835	846	850	850
Sodium sulfate, concentrates		562,660	556,575	523,285	550,000	550,000
Stone:						
Dolomite		975,971	1,158,539	2,109,362	2,200,000	2,500,000
Limestone, other than for cement	thousand metric tons	30,261	28,609	30,963	35,000	40,000
Marble	cubic meters	557,630	544,629	668,996	800,000	1,200,000
Quartzite		2,006,654	2,908,584	2,961,932	3,200,000	3,400,000
Strontium minerals, celestite:[e]						
Run of mine		116,278 [3]	116,000 [3]	100,000	100,000	20,000
Concentrates		70,000	70,000	60,000	60,000	12,000
Sulfur:[e]						
Byproduct:						
Petroleum		48,000 [3]	42,000	49,000 [3]	54,000 [3]	55,000
Other		75,000	46,000	19,000	20,000	15,000
S content of pyrites		34,000	28,000	20,000	20,000	20,000
Total		157,000	116,000	88,000	94,000	90,000
Talc		98	60	60	100	100
MINERAL FUELS AND RELATED MATERIALS						
Asphalt, natural		118,235	217,759	738,915	1,761,500 [r, 3]	2,220,400 [3]
Carbon black		37,413	6,754	32,686	26,820 [3]	51,788 [3]
Coal:						
Hard coal, run of mine	thousand metric tons	3,313	3,090	2,843	3,050 [3]	3,071 [3]
Lignite, run of mine	do.	49,627	43,749	43,754	55,626 [3]	61,006 [3]
Coke and semicoke	do.	2,080	2,543	2,855	2,800	
Gas, natural, marketed	thousand cubic meters	268,000 [e]	275,947	344,196	600,000	750,000
Petroleum:						
Crude	thousand 42-gallon barrels	17,579	16,980	16,270	16,500	13,600
Refinery products:						
Liquefied petroleum gas	do.	8,580	7,960	8,340	8,900	9,300
Gasoline	do.	31,634	28,800	27,350	30,300	30,800
Naphtha	do.	11,947	10,700	12,700	11,500	11,500
Jet fuel	do.	9,368	13,300	14,000	15,800	16,900
Kerosene	do.	312	540	340	124	200
Distillate fuel oil[10]	do.	59,281	53,800	53,660	56,400	56,800
Lubricants	do.	2,090	1,960	2,050	2,400	2,300
Residual fuel oil	do.	53,077	38,600	40,270	42,100	36,600
Asphalt	do.	7,548	8,550	8,430	10,700	13,400
Unspecified[11]	do.	6,125	2,640	3,610	1,050	5,300
Total	do.	189,962	166,850	170,750	179,000	183,000

See footnotes at end of table.

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TABLE 1--Continued
TURKEY: PRODUCTION OF MINERAL COMMODITIES[1]

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised. NA Not available. -- Zero.
[1]Table includes data available through November 16, 2007. In addition to the commodities listed, large quantities of construction materials (clay, and sand and gravel) are quarried. Also mined are basalt, diabase, granite, onyx, sandstone, serpentine, slate, and travertine for building stone; limestone and gypsum for cement manufacture; and garnet, iron oxide pigment, molybdenum, olivine, titanium, tungsten, and zeolite, but available information is inadequate to make estimates of output. Asbestos also may have been produced in 2006.
[2]Data are for public sector production only. Data for private sector production are not available, but production is believed to be approximately 30,000 metric tons per year.
[3]Reported figure.
[4]Approximately 70% of gross production is salable product.
[5]Copper mines produce a copper concentrate (of about 22% Cu) and a cupreous pyrite concentrate (of about 0.7% Cu). Copper is not recovered from the cupreous pyrite concentrate.
[6]Data includes estimated content of Turkish copper refinery tankhouse slimes.
[7]Does not include manganiferous iron ore from the Deveci Mine, production of which amounts to several hundred thousand metric tons per year and has a manganese content of between 3% and 5%.
[8]Includes estimated content of base-metals-refinery tankhouse slimes.
[9]Estimated sales only.
[10]Diesel fuel (gasoil) and special heating oil.
[11]Includes refinery fuel and losses.

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The Mineral Industry of the United Arab Emirates

By Philip M. Mobbs

The production of hydrocarbons and international and regional trade were significant facets of the diversified economy of the United Arab Emirates[1] (U.A.E.). Of the seven Emirates, Abu Dhabi accounted for most of the country's crude oil production. Dubai Aluminium Co. Ltd. (Dubal) accounted for about 2% of the world's primary aluminum supply (Bray, 2007, p. 5.17).

All mineral resources were controlled by the individual Emirates and administered by the Federal Government's Ministry of Petroleum and Mineral Resources. The Federal Environmental Agency and local authorities in each Emirate administered Federal law No. (24) of 1999 for the Protection and Development of the Environment.

In 2006, the value of the U.A.E.'s total exports (freight-on-board), which included reexports, was estimated to be $142.6 billion, which was up significantly from a revised $117.2 billion in 2005. The U.A.E. was a significant regional transshipment point, and reexports were estimated to account for about 32% of total exports. The value of crude oil and condensate exports from the U.A.E. was estimated to be $58.1 billion in 2006 (about 41% of total exports) compared with $43.5 billion in 2005 (about 37% of total exports). Much of the increase in the value of crude oil exports could be attributed to an increase in the average price received per barrel of crude, which was $63.53 in 2006 compared with $53.56 per barrel in 2005. Natural gas exports were valued at $7.1 billion, and refined petroleum products, $4.9 billion. Reexports of rough diamond were valued at $2.4 billion. In 2006, the value of total imports (cost, insurance, and freight) was estimated to be $86.1 billion, of which the import of about 43 million carats of rough diamond accounted for about $1.6 billion (Jbili and others, 2007, p. 8, 28; Kimberley Process, 2007).

Minerals in the National Economy

In 2006, crude oil and natural gas accounted for about 26% of the gross domestic product; the manufacturing sector (which included the production of processed mineral-based commodities), about 14%; the construction sector, about 9%; and other mineral production, 0.3%. Of the country's labor force of about 2.8 million, about 647,000 worked in the construction sector, about 362,000 in the manufacturing sector, about 30,000 in the crude oil and natural gas sector, and about 6,000 in mining and quarrying (Jbili and others, 2007, p. 2, 9).

Production

In 2006, significant increases were noted in the estimated production of aluminum, gasoline, and lime. Data on mineral production are provided in table 1.

[1]Comprises the following Emirates: Abu Dhabi, Ajman, Dubai, Fujairah, Ras Al Khaimah, Sharjah, and Umm al-Qaywayn.

Structure of the Mineral Industry

The governments of the Emirates maintained significant interest in the country's mineral industry. In 2006, the country's sole primary aluminum producer was owned by a Dubai government investment organization. Owners of cement companies included both government and private investors. Hydrocarbons were produced primarily by companies in which the governments held majority interest.

In 2006, Dubai Metals and Commodities Centre changed its name to Dubai Multi Commodities Centre (DMCC). The Government designated that the Dubai Diamond Exchange, which was a unit of the DMCC, was to be the sole importer and exporter of diamond.

Commodity Review

Metals

The Environment Agency-Abu Dhabi and GRM International (Pty.) Ltd. of Australia started phase 2 of a soil survey of Abu Dhabi. The Environment Agency-Abu Dhabi projected that the soil survey could be used as basic background information for mineral exploration in the Emirate. The United Arab Emirates University signed an agreement with the National Key Centre for Geochemical Evolution and Metallogeny of Continents of Macquarie University of Australia to prospect for gold and platinum-group metals in the Hajar Mountains.

Aluminum.—In November, Dubal officially started potline 7B at its Dubai aluminum smelter, which added 128 pots to potline 7, and started potline 9B, which added 36 pots to potline 9. By yearend, the aluminum smelter's total hot-metal capacity had reached 861,000 metric tons per year (t/yr). In 2006, Dubal was adding 32 pots to potline 5 (as potline 5B) and 40 pots to potline 6 (as potline 6B). The addition of potlines 5B and 6B, which would expand Dubal's capacity by 60,000 t/yr, was expected to be completed in late 2007. Dubal also was considering a 600,000-t/yr-capacity expansion with the addition of two new potlines (10 and 11) (Dubai Aluminium Co. Ltd., 2006b; Middle East Economic Digest, 2006f).

Emirates Aluminium, which was a joint venture of Dubal and Mubadala Development Corp. (the Emirate of Abu Dhabi's investment organization) that was formed in February 2006, fast-tracked plans for a proposed aluminum smelter in Abu Dhabi. By November, Emirates Aluminum had completed a feasibility study of the proposed 1.4-million-metric-ton-per-year (Mt/yr)-capacity smelter, which was to be located in the Khalifa Port and Industrial Zone at Taweelah. The $5 billion 700,000-t/yr-capacity phase 1 of the project was expected to be operational in 2010 (Dubai Aluminium Co. Ltd., 2006a).

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Abu Dhabi Aluminium Co. (a joint venture of the General Holding Co. of Abu Dhabi and Rio Tinto Group's Comalco Aluminium division) proposed to build a 550,000-t/yr-capacity aluminum smelter at Ruwais in Abu Dhabi by 2011. The proposed project would encompass the possible expansion of smelter capacity to 2 Mt/yr and the potential construction of a 2-Mt/yr-capacity alumina refinery. General Holding Co. was the industrial diversification organization of the Emirate of Abu Dhabi. In November, Comalco Aluminum became Rio Tinto Aluminum (Middle East Economic Digest, 2006a).

Copper.—Emirates Link Group of the U.A.E. and the Kembla Rod and Wire division of MM Kembla of Australia proposed to build a copper rod plant in Abu Dhabi. The plant's cast house and rolling mill were to be built at Mussafah.

Industrial Minerals

Nitrogen.—Ruwais Fertilizer Industries proposed to add a 2,500-metric-ton-per-day (t/d)-capacity granulation unit to its 1,700-t/d-capacity urea plant. In 2006, actual urea production, which was prilled, exceeded nameplate capacity (Middle East Economic Digest, 2006b).

Green Dome Petrochemicals imported and began the refurbishment of a 1,180-t/d-capacity ammonia plant. The plant, which formerly was operated by Cooperative Farm Chemicals Association of Kansas, was being rebuilt in the Hamriya free zone in Sharjah and was expected to begin production in late 2007 (Middle East Economic Digest, 2007).

Salt.—Al Ghaith Holding PJSC of the U.A.E. and the Geology Department of the United Arab Emirates University began a study of the production of salt from coastal evaporation ponds along the Khor al Bazam, which was located west of Abu Dhabi. Domestically produced solar salt could be substituted for industrial salt imported by the U.A.E.'s chemical industries.

Silica.—The regional construction boom significantly increased the demand for glass in the region. Silica sand accounts for about 70% of the raw materials used to manufacture glass. In 2006, construction started on a 600-t/d-capacity float glass plant at Industrial City Abu Dhabi at Mussafah for Emirates Float Glass, which was a subsidiary of Dubai Investments PSJC of the U.A.E., and a 700-t/d-capacity plant in Ras al-Khaimah for a joint venture of Saudi Guardian International Float Glass Co., Ltd. of Saudi Arabia and partners Guardian Industries Corp. of the United States, National Co. for Glass Industries Ltd. of Saudi Arabia, and Al Zamil Group of Saudi Arabia. Al Hamed Enterprises of the U.A.E. and the Pilkington Group Ltd. of the United Kingdom proposed to build a 550-t/d-capacity float glass plant in the Industrial City Abu Dhabi. At yearend, Dubai Investments announced the transfer of its glassmaking subsidiaries in the U.A.E., which included Emirates Float Glass, Emirates Glass LLC, and Lumiglass Industries, to the newly formed corporate division, Glass LLC (Guardian Industries Corp., 2006; Middle East Economic Digest, 2006d; Securities and Commodities Authority of the United Arab Emirates, 2007).

Sulfur.—Abu Dhabi Oil Refining Co. (TAKREER) proceeded with plans to expand the handling capacity of the Ruwais Sulphur Handling Terminal to nearly 10,100 t/d by 2008 from 7,650 t/d. The expansion would include a new loading dock, sulfur granulation units, and storage tanks for liquid and solid sulfur (Middle East Economic Digest, 2006e).

The Camberley, United Kingdom, office of Fluor Corp. was building 1,600-t/d-capacity sulfur recovery units for Abu Dhabi Gas Industries Co.'s Habshan complex, which processed associated natural gas from the Bab and the Bu Hasa oilfields. The project was expected to be commissioned in 2008. Abu Dhabi Gas Industries Co. also proposed to build a 400,000-metric-ton-capacity sulfur storage facility at Habshan (Gulf Oil & Gas.com, 2005; Middle East Economic Digest, 2006c).

Mineral Fuels

Petroleum.—In January, construction of a 12,000-barrel-per-day (bbl/d)-capacity catalytic reformer plant and a 19,000-bbl/d-capacity isomerization plant was completed for TAKREER. The new plants, which were located at the Ruwais refinery, allowed TAKREER to increase gasoline production (Abu Dhabi Oil Refining Co., 2006).

Outlook

The U.A.E. has significant natural gas reserves to draw upon, but relatively little locally produced natural gas is liquefied and exported; the volume of locally produced liquefied natural gas (LNG) is not expected to increase significantly, although the DMCC proposed to build a $1 billion 1.8-million- to 3-million-metric-ton-capacity LNG storage and trading facility in Dubai. The storage facility would allow traders to purchase LNG during off peak (lower cost) periods (Dutta, 2006a).

To meet partially the anticipated increased demand from the industrial sector, natural gas production is projected to increase by 20% by 2010. Domestic production will be supplemented by gas imported from Qatar by the Dolphin pipeline, which is expected to begin flowing in 2007. Most of the natural gas will be processed and reinjected to maintain oilfield reservoir pressure. Electricity-generating powerplants and proposed aluminum production and steel-processing facilities also would depend on the availability of natural gas to power their facilities (Dutta, 2006b).

Most of the U.A.E.'s natural gas output is produced as a coproduct of crude oil production and is "sour"; that is, it has a highly-corrosive hydrogen sulfide content ranging from 2% [20,000 parts per million (ppm)] to 10%. Abu Dhabi National Oil Co. projects that it eventually would need to develop reservoirs with hydrogen sulfide contents of as high as 30%. Handling costs associated with the production of such sour gas reserves are significant. In addition to the deterioration of downhole and surface equipment, natural gas that subsequently is reinjected into oil reservoirs to maintain reservoir pressure typically is processed to reduce hydrogen sulfide content to about 50 ppm.

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TABLE 1
UNITED ARAB EMIRATES: ESTIMATED PRODUCTION OF MINERAL COMMODITIES[1, 2]

(Metric tons unless otherwise specified)

Commodity[3]		2002	2003	2004	2005	2006
Aluminum, primary		536,000	560,000	683,000	722,000	861,000
Cement, hydraulic		7,000,000	8,000,000	9,000,000 r	9,800,000 r	9,800,000
Chromium, gross weight		(4)	(4)	7,089 5	(4)	(4)
Gas, natural:						
Gross	million cubic meters	55,000	60,000	61,000	62,000	63,000
Dry	do.	42,000	44,400 5	45,400 5	46,400 5	47,000 5
Gypsum		90,000	100,000	110,000 r	120,000 r	130,000
Lime		50,000	50,000	50,000	50,000	60,000
Natural gas plant liquids	thousand 42-gallon barrels	115,000	115,000	115,000	105,000 r	100,000
Nitrogen:						
N content of ammonia		363,700 5	421,000	380,400 5	360,000	380,000
N content of urea		260,000	300,000 r	270,000 r	260,000	270,000
Petroleum:						
Crude	thousand 42-gallon barrels	675,000	790,000	820,000	830,000	900,000
Refinery products:[6]						
Gasoline	do.	11,400	11,000	20,000	20,000	30,000
Kerosene	do.	39,000	40,000	50,000	50,000	50,000
Distillate fuels	do.	34,900	33,800	45,000	45,000	48,000
Residual fuels	do.	11,300	7,800	20,000	20,000	19,000
Other	do.	58,300	38,400	65,000	65,000	60,000
Total	do.	155,000	131,000	200,000	200,000	207,000
Steel		70,000	50,000	70,000	70,000	70,000
Sulfur, byproduct of petroleum refining and natural gas processing		1,900,000	1,900,000	1,930,000	1,950,000	1,950,000

rRevised.

[1]Estimated; estimated data and totals are rounded to no more than three significant digits.

[2]Table includes data available through November 14, 2007.

[3]In addition to the commodities listed, crude industrial minerals, such as common clays, diabase, gravel, limestone, marble, sand, and shale presumably are produced, but output is not reported, and information is inadequate to make estimates of output.

[4]Negligible or no production.

[5]Reported figure.

[6]Average daily production data converted assuming a 350-day operating year and rounded to no more than three significant digits; may not add to totals shown.

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TABLE 2
UNITED ARAB EMIRATES: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Thousand metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Aluminum		Dubai Aluminum Co. Ltd. (Investment Corp. of Dubai, 100%)	Jebel Ali, Dubai	861
Cement:				
Portland		Gulf Cement Co. (National Investments Co. of Kuwait, 27%, and Government of Ras Al Khaimah, 8%)	Khor Khuwair, Ras Al Khaimah	2,700
Do.		Sharjah Cement and Industrial Development Co. (private, 70%, and Government of Sharjah, 30%)	Sharjah	2,000
Do.		National Cement Co. P.S.C.	Dubai	1,500
Do.		Union Cement Co. (Government of Ras Al Khaimah, 41%, and Abu Dhabi Investment Authority, 20%)	Khor Khuwair, Ras Al Khaimah	1,400
Do.		Fujairah Cement Industries	Dibba, Fujairah	1,200
Do.		Emirates Cement Factory (General Holding Corp.)	Al-Ain, Abu Dhabi	1,000
Do.		Ras Al Khaimah Cement Co.	Khor Khuwair, Ras Al Khaimah	1,000
Do.		Arabian Gulf Cement Co. L.L.C.	Ajman	900
Do.		Jebel Ali Cement Co. (Sharaf Industries, 100%)	Jebel Ali, Dubai	800
Do.		Umm al-Qaywayn Cement Industries Co.	Umm al-Qaywayn	500
White		Ras Al Khaimah Co. for White Cement and Construction Materials	Ras Al Khaimah	450
Gold, refined	metric tons	Emirates Gold (private, 100%)	Dubai	200
Do.	do.	Al Ghurair Giga Gold (private, 100%)	Dubai	100
Do.	do.	ARY Aurum Plus (private, 100%)	Sharjah	25
Natural gas, liquefied		Abu Dhabi Gas Liquefaction Co. Ltd.	Das Island	5,149
Petroleum:				
Crude	thousand barrels per day	Abu Dhabi Company for Onshore Oil Operations (Abu Dhabi National Oil Co., 60%; BP p.l.c., 9.5%; Exxon Mobil Corp., 9.5%; Royal Dutch Shell Group, 9.5%; Total S.A., 9.5%; Participations and Explorations Corp., 2%)	Onshore Abu Dhabi oilfields included the Asab, the Bab, the Bu Hasa, the Jarn Yaphour, the Sahil, and the Shah Fields	1,400
Do.	do.	Abu Dhabi Marine Operating Co. (Abu Dhabi National Oil Co., 60%; BP p.l.c., 14.67%; Total S.A., 13.33%; Japan Oil Development Corp., 12%)	Offshore Abu Dhabi oilfields included the Umm Sharif and the Zakum Fields	600
Do.	do.	Zakum Development Co. (Abu Dhabi National Oil Co., 63.36%; ExxonMobil Abu Dhabi Offshore Petroleum Co. Ltd., 24.64%; Japan Oil Development Corp., 12%)	Offshore Abu Dhabi oilfields included the Satah, the Umm Al-Dalkh, and the Upper Zakum Fields	500
Do.	do.	Dubai Petroleum Co. (ConocoPhillips Co. of the United States, 100%), and Dubai Marine Areas Ltd. (ownership interest includes Repsol YPF, RWE Dea AG, Total S.A., and Wintershall AG)[1]	Offshore Dubai oilfields	90
Refined products	barrels per day	Abu Dhabi Oil Refining Co. (Abu Dhabi National Oil Co., 100%)	Ruwais Refinery, Ruwais, Abu Dhabi	460,000
Do.	do.	Emirates National Oil Co. (Investment Corp. of Dubai, 100%)	Jebel Ali Refinery, Jebel Ali, Dubai	120,000
Do.	do.	Abu Dhabi Oil Refining Co. (Abu Dhabi National Oil Co., 100%)	Abu Dhabi Refinery, Umm Al Nar, Abu Dhabi	90,000
Do.	do.	Sharjah Oil Refining Co. Fzc (FAL Group, 100%)	Sharjah Refinery, Hamriyah Free Trade Zone, Sharjah	85,000
Do.	do.	Inactive refinery, formerly operated by Metro Oil Corp.	Fujairah	82,000
Silver, refined	metric tons	Emirates Gold (private, 100%)	Dubai	100

[1]Dubai Petroleum Establishment, which is a newly formed entity owned by the government of Dubai, will assume operatorship of the oilfields in April 2007.

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The Mineral Industry of Yemen

By Philip M. Mobbs

Production and processing of crude oil accounted for a significant portion of the Republic of Yemen's gross domestic product (GDP). In 2006, the oil sector accounted for 11% of the GDP and mining accounted for about 0.5%. The oil sector also accounted for 92% of merchandise exports and 75% of Government revenue (van Rooden and others, 2007, p. 3, 11, 23).

In 2006, the International Finance Corporation, which was an affiliate of the World Bank, and the Ministry of Oil and Minerals of Yemen agreed to begin a project to develop a national mining policy and to review Yemen's mining laws and regulations. The program was expected to review and reform administrative procedures that were associated with the mining sector and to increase the private sector involvement in the development of the country's mineral industry.

Production

Although domestic and international companies had advanced several metal exploration projects, mine production in 2006 was limited to industrial minerals—primarily limestone for domestic cement plants, and gypsum and salt for domestic use or the export market. The estimated 27% increase in marble production and almost 16% increase in gypsum output could be attributed to increased domestic and regional construction. Crude oil production continued to decline in 2006. The economic impact of the nearly 9% decline in crude oil production in 2006 compared with 2005 was offset by increased international oil prices.

Structure of the Mineral Industry

The Ministry of Oil and Minerals was responsible for the mineral sector in Yemen. The Geological Survey and Minerals Resources Board supervised solid mineral activity. Metal and industrial mineral exploration and production operations were governed by the Mines and Quarries law No. 24 of 2002. Mineral projects also were subject to the provisions of the Investment law No. 22 of 2002.

Natural gas and petroleum exploration and production activities were supervised by the Petroleum Exploration and Production Authority. Oil projects were governed by production-sharing agreements, which, when approved by the Government, were promulgated as individual laws. Crude oil was refined by the Government's Aden Refinery Co. and the private sector's Yemen Refining and Marketing Co.

Commodity Review

Metals

Gold.—Cantex Mine Development Corp. completed a 43-hole drilling program at the Al Hariqah gold prospect. Thani Dubai Mining Co. of the Cayman Islands explored for gold in the Wadi Maddan and the Wadi Sharis areas. In late 2006, Volrock Mining Ltd. of the United Kingdom received a permit to explore for gold in the Ahim-Washah, the Haydan-Saqayn, and the Wadi Hard-Jabal Balan areas.

Iron Ore.—In late 2006, Yemen Iron Steel Ltd. Co. received a permit to begin exploration for iron ore in the Al-Thaniah region.

Zinc.—In October, the Cabinet approved the contract for the development of the Jabaili zinc deposit by Jabal Salab Co. Ltd., which expected to begin zinc oxide production in late 2008 or early 2009. The contract was passed to the Parliament for approval. Anglo American plc of the United Kingdom subsequently withdrew from the Jabal Salab joint venture because the project's planned annual production levels did not meet Anglo's development criteria. At yearend, Jabal Salab Co. Ltd. comprised two partners—ZincOx Resources plc of the United Kingdom (52% interest) and Ansan Wikfs (Hadramaut) Ltd. (48%) (ZincOx Resources plc, 2006).

Mineral Fuels

Petroleum.—In 2005, Yemen Exploration and Production Co. (YEPC), which was a joint venture of Yemen Hunt Oil Co. (51% equity interest) and Exxon Yemen, Inc. (49%), filed for arbitration against the Government. The Government terminated YEPC's operations on Block 18 (Marib al Jawf) during the initial year of a 5-year extension of the production-sharing agreement, and installed Safer Exploration and Production Operations Co. of Yemen (also known as Safir Exploration and Production Operations Co.) as the field operator (U.S. Securities and Exchange Commission, 2007, p. 11).

In 2006, crude oil production began from Block S-2, which was operated by OMV (Yemen) Al Mabar Exploration GmbH of Austria. Production from Blocks 9 and 43, which started production in 2005, was ramped up; however, large declines, which ranged from 10% to 37%, were reported for Blocks 4, 14, 18, 32, and 53. In 2007, exploration was expected to increase in Yemen because high international oil prices had allowed the transformation of marginal prospects into economically viable oilfields.

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TABLE 1
YEMEN: PRODUCTION OF MINERAL COMMODITIES[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]		2002	2003	2004[e]	2005[e]	2006[e]
Cement		1,561	1,541	1,546 [3]	1,550 [3]	1,550
Gypsum		41	42	37	38	44
Marble	thousand square meters	99	98	97	100	127
Natural gas:[e]						
Gross[4]	million cubic meters	29,991 [3]	30,000	28,500	29,500	28,100
Flared and used	do.	956 [3]	1,000	1,000	1,000	1,220
Liquids[5]	thousand 42-gallon barrels	6,890 [r, 3]	7,360 [r, 3]	7,830 [r, 3]	7,960 [r, 3]	8,220 [3]
Petroleum:						
Crude	do.	159,924	157,270 [r]	147,500 [r, 3]	146,090 [r, 3]	133,330 [3]
Refinery products:[5]						
Naphtha	do.	3,100	1,200 [r]	1,100	1,200 [r]	1,200
Gasoline[6]	do.	7,200	9,000 [r]	9,700 [r]	10,200 [r]	10,000
Kerosene	do.	3,450	3,800 [r]	3,100	1,700 [r]	1,700
Distillate fuel oil	do.	13,800	16,000	16,900	18,200 [r]	18,000
Residual fuel oil	do.	6,770	10,000	9,000	6,800 [r]	6,800
Other[e]	do.	420	640	640	690 [r]	700
Total[e]	do.	34,700 [r]	40,600 [r]	40,400 [r]	38,800 [r]	38,400
Salt		125	116	88	90	90
Sand and gravel		612	624	668	1,030 [r, 3]	1,000
Stone, quarried		2,288	2,333	2,269 [3]	2,300	2,300

[e]Estimated; estimated data are rounded to no more than three significant digits; may not add to totals shown. [r]Revised.

[1]Table includes data available through September 28, 2007.

[2]In addition to the commodities listed, feldspar and silica sand may have been produced; aggregate, limestone, mica, pumice, rolled steel bars, scoria, and talc were also produced, but available information is inadequate to make reliable estimates of output.

[3]Reported figure.

[4]Most natural gas that was produced was stripped of hydrocarbon liquids and reinjected.

[5]Natural gas liquids include liquefied petroleum gas produced at the Aden refinery.

[6]Formerly listed as Benzene.

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TABLE 2
YEMEN: STRUCTURE OF THE MINERAL INDUSTRY IN 2006

(Metric tons unless otherwise specified)

Commodity		Major operating companies and major equity owners	Location of main facilities	Annual capacity
Cement		Amran Cement Factory (Yemen Cement Manufacturing and Marketing Co., 100%)	Kilns and mills at Amran	600,000
Do.		Al Barh Cement Factory (Yemen Cement Manufacturing and Marketing Co., 100%)	Kilns and mills Mafraq, near Taiz	580,000
Do.		Bajil Cement Factory (Yemen Cement Manufacturing and Marketing Co., 100%)	Kilns and mills at Bajil	262,000
Do.		Al Mukalla Raysut Cement Co. (Raysut Cement Co.)	Mukalla	NA [1]
Natural gas	million cubic meters	Safer Exploration and Production Operations Co. (Government, 100%)	Block 18	20,000 [2]
Do.	do.	Yemen Exploration and Production Co. (Yemen Hunt Oil Co., 51%, and Exxon Yemen, Inc., 49%)	Block 14	10,000 [2]
Petroleum:				
Crude	million 42-gallon barrels	Crude oil was produced under 11 production-sharing agreements, which comprised nine contracts with joint ventures that included domestic or international partners, two agreements with single companies, and one Government-owned operation.	Oilfiled on Blocks 4, 5, 9, 10, 14, 18, 32, 43, 51, 53, S-1, and S-2	160
Refined	42-gallon barrels per day	Aden Refinery Co. (Government, 100%)	Refinery at Aden	70,000
Do.	do.	Yemen Refining and Marketing Co., (Yemen Hunt Oil Co. and Exxon Yemen, Inc., 75.5%, and Yukong Group, 24.5%)	Topping plant at Marib	10,000
Salt:				
Crude:				
Marine		Local private companies	Eleven saltworks near Aden	150,000
Rock		do.	Five salt mines near Salif	140,000
Refined		Salt Refining and Packing Factory (Government)	Salif	NA
Do.		Aden Salt Factory (Government)	Aden	NA
Stone		Local private companies	Dhamar, Mayana, Sana'a, Taiz, and Wadi Marek areas	NA

NA Not available.
[1]Company imported cement through Aden terminal.
[2]Most natural gas that was produced was stripped of hydrocarbon liquids and reinjected.

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